THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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Joint Manager and Secretary: E. S. MIDDLETON.

Chairman & Managing Director: H. ALABASTER.

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A NEW SCHEME FOR ELECTRICAL TRADE ORGANISATION.

On the commercial side of the electrical industry no single subject has been so long with us as that of organisation. There was a time when every man's hand seemed to be against his fellow's. Out of the chaos and confusion there arose appeals for unity; for the recognition that the progress of the industry was a matter of common as well as individual interest; for insensate competition to cease and for sectional co-operation to supersede individual isolated policy and action so that there might be conference and confederation between sections making for the good of all.

In the search for remedies many plans were evolved. Some were ambitiously designed in the vain hope that we need only draw everybody electrical into one big crowd and all would be well. Others were too plainly the propositions of individuals obsessed with one idea. But experience has always shown that no great and lasting achievements of such a kind are effected by a stroke of the pen or the waving of a wand. Those who have followed the course of the industry up the steep pathways of the past five and twenty years know quite well that it has only been gradually and step by step that the way to the present measure of efficiency and security has been cut. Looking backward they are able to appreciate how great are the advances that have been made as discussion following upon discussion has eventuated in the formation of representative organisations for sectional supervision, protection, and development which have subsequently come into co-operative and co-ordinated form. It is the ability to look back which impresses one with the marvellous improvement that has taken place in so many directions; indeed, were one to arise from the dead after a quarter of a century and to look around him in our midst to-day he would probably be astounded to find that in 1923 the old subject of electrical organisation was still under discussion and that the conditions as we regard them to-day call for a renewed united effort. Yet the pages of the technical Press, informal gatherings of electrical men, and conferences of sections, continue to bear evidence to the need for the best minds to concern themselves with problems which are to some extent similar to those which confronted us before there was any concerted policy. It must not be supposed that this means that organisation efforts have failed, for such is far from being the case. Indeed, we sometimes doubt whether things are as bad as they are painted. The conditions affecting the electrical industry, like its personnel, are constantly changing; the growth of the industry to its present large proportions, and the certainty that it will rapidly grow bigger and bigger quite beyond present conceptions; and the general influences that are at work in the trade—all these things compel an orderly and systematic investigation so that we may work forward persistently and consistently in the hope of attaining an end which in the light and knowledge of to-day seems to be desirable in the general interests.

For some time past there has been a widespread opinion that some improvement should be brought about in the trading relations that have existed in recent years between manufacturers, wholesalers, contractors, and retailers so that all of these sections might reap

their fair share of benefit from the enormous progress that takes place in the industry as a whole as electricity comes into its own in domestic and industrial installation work and trading operations associated therewith or resulting therefrom.

A serious effort has been made by the Electrical Contractors' Association to lead the way in dealing with the situation. It has formed the subject of deliberations by men with intimate knowledge of the ramifications of the trade and lengthy experience of its problems and difficulties. They have endeavoured to secure that a basis shall be laid "upon which an improved relationship may be built up"; they have sought to afford "a compass rather than a chart"; and they seek to "direct and guide without binding." When it is noted that these representative men have considered the matter one which could claim their close attention for so long a period as six months, it will immediately be felt that the scheme that they have evolved is deserving of sympathetic inquiry, and investigation of its merits, from all who have either the immediate or the future greatness and prosperity of the industry at heart. In the desire to inform our readers and to secure from them the fullest possible discussion of the proposals, we print the complete report and recommendations of the Special Policy Committee in this issue of the Review.

For many reasons the present position of electrical retailing is far from satisfactory; yet in order to secure as widespread an activity as possible in the sale of electrical appliances to meet the daily needs of a public which is rapidly increasing its uses of electricity and therefore of electrical goods, it is necessary that the retail position should be as free as is humanly possible from weakness, restriction, and limitation, and that the electrical trade door shall be open as wide as the well-being of electrical development renders desirable, for the incoming of new men to earn a decent livelihood and assist the general advance.

One of the objects of the now enunciated policy is to encourage a large and thoroughly substantial retail section of the industry. It is not anticipated by the originators of the policy that the recommendations made to that end can be immediately effective, inasmuch as most ideals are well beyond present attainment, but it is hoped that eventually such an arrangement will be reached as will be reflected in all future trading agreements. By co-operation "or otherwise," it will be observed, it is hoped to secure the adoption of a broad principle of trading which shall establish the membership in a sound financial and commercial position so that it can control its own business without undue interference from other sections. The Association requires to have a part in regulating and improving the conditions of retail electrical trading.

Where the interests of the entire electrical industry have to be studied and protected, as is only right in the pages of the electrical trade Press, it is not congenial to advocate the elimination of anybody unless he is unmistakably doing harm to the interests of the industry—is parasitic, obstructive, fraudulent and so forth. But ready as we have always been to welcome all and sundry into the field of electrical development because the more there are to gain an electrical livelihood, the more business-pushers, business-getters, and electrical propagandists there will be, we are not blind to the harmful influence of the weak man who comes into the business with little or no capital, does little work and that not of the best, gets into debt, lowers the value of contracting and supply orders because of his undercutting, goes bankrupt and saddles manufacturers and traders with bad debts.

We desire to see good work, a fair profit for all, and the elimination of influences which spoil the business for everybody. But not all small men do this. For one who does, as manufacturers and traders could tell us, there are very many who do not. Small men of enterprise have become important amongst us, and we hope that they will continue to become so—nothing could be more detrimental than for there to be a closed door; men of new blood and new ideas should not have serious difficulties put in their way. There are districts where, if it were not for the small man there would perhaps be nobody. It may be asked how the Association scheme will affect men of this class. It is hoped to reduce costs to electrical users and increase the turnover of the industry while strengthening the financial position of the contractors. How is it to be done? One way would be by eliminating the intervention of the middleman between the manufacturer and contractor or retailer, excepting where wholesalers are able to buy largely and stock largely. Contractors and retailers will reduce costs because they will be able to buy in quantity and at special terms. Here it may be that the small man will be at a disadvantage, being a small and hand-to-mouth buyer, though, of course, he will be free from the heavy standing charges of the big man.

There are intentions that members when financially strengthened by the effective operation of the scheme, shall run retail showrooms, and shall bring new developments to the notice of the public, while manufacturers and wholesalers shall be discouraged from direct trading, and if they do supply the user in agreed cases, the price shall be an agreed one leaving a profit for the retailer. This matter of direct supply and the allowance of discounts to users is perhaps the oldest of all the points of grievance that have existed in the trade. It was out of the evils of direct trading that the Electrical Contractors' Association came to birth.

There are proposals affecting the future of those who have hitherto acted in the dual capacity of manufacturer and contractor; and electrical contractors are not to compete with manufacturers and wholesalers. There is to be co-operation of electrical contractor members in schemes for the electrical education of the public. Preferential consideration is to be given to British manufacturers. All of these things are very good. A new section of the E.C.A. is to be formed providing for electrical retailers to become members, and altogether the end aimed at will be to attract capital and the best men to the electrical contracting and retailing side of the industry.

Having thus briefly outlined the position, and summarised the aims which are seriously set forth by the proposers and advocates of the scheme, we now, without at the moment attempting any closer analysis and discussion of the many points, definitions and recommendations, pass the entire matter on to our readers in the belief that they will feel it to be their duty to give it thorough consideration. Our columns are open to them for the expression of their views, and we hope that they will avail themselves of the opportunity. It is desirable that there should be the fullest possible discussion of the scheme, as if in its operation it can bring about one more advance toward the efficiency of the trades affected, the industry as a whole should be advantaged and the ever-recurring complaining between section and section will be moderated if not altogether silenced. Frankly, we may say that while the highest ideal should be set before us, and while the attainment of that ideal is worthy of a bold and self-sacrificing effort, we agree with the Committee that improvement and not perfection can be secured. There are factors which will always operate against the complete realisation of the ideal.

The Lighting of Printing Works.

Attention is often drawn to the desirability of creating some form of "bridge" between the technical expert and the public. Electrical engineering is now so highly specialised that this is not an easy problem. But in the case of lighting, the interests of the producer and user are so closely related that there are excellent opportunities for the interchange of views. The discussion before the Illuminating Engineering Society on the lighting of printing works on

April 24th was a happy illustration of the good results attending conferences with users. The Society had invited the attendance of representatives of the leading journalistic and printing associations, including the Joint Industrial Council of the Printing and Allied Trades of the United Kingdom. The Rt. Hon. C. W. Bowerman, a past president of this body, opened the discussion, and its two secretaries also gave a warm welcome to the investigation which the Society is conducting. Mr. L. Gaster, who read the introductory paper, covered a wide field. The problems involved in the lighting of compositors' frames, machining rooms, linotype machinery, &c., are highly complex, and the ideal methods have still to be evolved. But there can be no question that a solution of these problems can only be found by enlisting the help of the worker. The lighting of editorial offices appears a much simpler problem, but it is common knowledge that in some newspaper buildings the conditions are antiquated and unsatisfactory. We are glad that Mr. Gaster put in a word for the requirements of the journalist, who is often called upon to work at high pressure without sacrifice of accuracy and whose occupation admittedly imposes a somewhat severe tax on eyesight.

Electric Lighting of Trains.

Without desiring to make capital out of a regrettable railway accident, involving the death of three men, we feel compelled to draw attention to the report of Col. J. W. Pringle upon the collision between an Aberdeen express and a goods train near Retford (L. & N.E. Rly.) on February 13th last. The whole of the passenger stock and the brake vans of the express were electrically lighted, and it is to this fact that Col. Pringle attributes the absence of fire upon the derailment of certain of the coaches.

We have consistently advocated the substitution of electricity for gas in train-lighting, and it is of greater satisfaction to us to see the avoidance of fire than to have our contentions supported by the addition of a fire due to the rupture of gas tanks to the already sufficiently-terrible consequences of a railway accident.

Improving Electrical Trade.

The chairman of the English Electric Company, Limited, Sir Chas. E. Ellis, informed shareholders last week that of its five factories in different parts of the country three were fully employed, the fourth was within sight of full employment, and in the fifth, which was temporarily closed some time ago and is still so, establishment charges had been reduced to a negligible figure. While it is found that trade continues to improve, events have proved the accuracy of the prediction that the upward lift, though steady, would be and still will be, long and tedious. The rate of advance last year, however, taking the value of orders received as the basis of comparison, was 75 per cent. on the figure for 1921, but more than that is necessary for the amalgamated company to be "really comfortable." That, of course, must be the case while a fifth factory remains closed. We may suppose, however, that progress towards that "comfortable" feeling—an experience lacking in many another case as well—is being made, from the fact that toward the end of 1922 the rate of inflow of orders was accelerated, and in the first three months of 1923 the improvement has been more than maintained. The electrical industry is closely interested in the revival of general industry, and, that being so, it is gratifying to notice that whereas the bulk of the English Electric turnover came from public works, private buyers being unable to finance new developments, this year there is an encouraging growth in the application of the company's standard electrical products to the steel and coal and other industries. It is well known that the company has for some time past laid itself out specially for the handling of railway electrification and hydro-electric power contracts. What success has resulted in these departments has been recorded here in several special cases. Its work in Japan and India and other parts of the world; its building-up of a specialist technical personnel; the attention which has been devoted to the development of turbine and turbo-alternator design; and its ability to secure Indian and Brazilian turbine plant orders against severe competition—all these form part of the very interesting story of the past and the hopeful forecast for the future that Sir Chas. Ellis was able to set forth in the statement that is recorded in our "City Notes" to-day.

Capital Levy Danger.

There is a significant pronouncement on the subject of a capital levy in the report on Switzerland by H.M. Commercial Secretary at Berne (Mr. E. C. D. Rawlins), which has recently been issued by the Department of Overseas Trade. It will be remembered that last autumn a referendum in Switzerland was taken on this question, and the scheme for a capital levy was rejected. It was thoroughly realised by a very large majority that the consequences of such a course would have been very serious indeed. As it was, there was a good deal of financial and commercial disturbance, such as exports of capital abroad, runs on local savings banks, a fall in all Government bonds, banking and industrial shares, and other signs of the approach of a panic. It is disquieting to think that similar disastrous occurrences might easily ensue in this country if our own electorate gave the reins of power into the hands of those who believe in the practicability of imposing a capital levy without killing the golden goose of industry. In spite of the heavy defeat of the Swiss proposal, it appears from Mr. Rawlins's report that an adverse influence has been exerted on Swiss economic life, the extent of which can never be accurately gauged. The Commercial Secretary cannot be accused of having any desire to prejudge a political issue at home. His remarks are simply those of an impartial and trained observer, whose duty it is to submit a plain record of economic events in the country to which he is appointed. His account of the injurious effects of the bare proposal of a capital levy, though rejected by the common sense of the Swiss, should therefore be given the fullest possible publicity.

Success to Whitleyism.

Whilst municipal electricity authorities have figured prominently in the history of Whitley Councils, we have not heard much of the views of the companies on this subject. It is therefore interesting to observe that, on the occasion of the annual meeting and conference of the Whitley Council for the South Coast District (No. 11) at Bournemouth last week, the delegates were entertained at luncheon by the Bournemouth and Poole Electricity Supply Co., Ltd., and the local chairman of directors, Dr. J. A. Hosker, took the opportunity to express his confidence in and approval of the Whitley system. According to the *Bournemouth Echo*, he said: "I believe in letting the other man have his say. If Whitley Councils are conducted on the principle of the round-table conference, then a great deal of goodwill comes from them. I have reason to believe that this Council has done a great deal of good." Incidentally, Dr. Hosker pointed out that the question of wages was not the sole purpose of the Councils—their outlook should be far wider. Sir John Timpson also held that the existence of the Councils had warded off serious troubles, and that the good of the industry must be their aim; if an undertaking was flourishing, all who were running the concern ought to benefit. The keynote of all the speeches was the good resulting from amicable discussion between the parties concerned, and the effectiveness of the councils in preventing disputes.

We firmly believe that, granted goodwill and good faith on both sides of the table, no difference of opinion need ever develop into a conflict; as Dr. Hosker remarked, one should look at the position from the other man's point of view as well as one's own. Peace, accompanied by contentment, is the first and greatest essential to the prosperity of the electrical industries.

AUTOMATIC MERCURY-VAPOUR RECTIFIERS.

The Birmingham Sub-station Installation.

One of the principal arguments against the use of low-pressure direct current for lighting outlying areas of a city, or of high-pressure direct current for a railway supply, has been the high cost of the shift labour which it has hitherto been necessary to employ to attend to the rotating apparatus installed in the sub-stations required for converting extra-high-pressure three-phase current into direct current.

Owing to this high cost of labour, the general practice has been to install a few large sub-stations on a system distributing direct current, and to place them at a considerable distance from one another; this arrangement has necessitated running out from such sub-stations long and costly low-pressure feeders of large sectional area to distribute the supply.

On the other hand, undertakings distributing low-pressure alternating current, owing to the fact that no shift labour is employed in the static transformer sub-stations, have been able to use a large number of such sub-stations and in this way to reduce to a minimum the capital expenditure on low-pressure cables.

With a view to meeting this disability, engineers both in this country and abroad have been working at the problem of devising automatically-controlled converting apparatus suitable for installation in sub-stations supplying systems which distribute low-pressure direct-current and, especially in the United States of America, many such sub-stations are now in successful operation, the converting apparatus usually consisting of either rotary converters or motor generators. Whilst the design and arrangement of the control apparatus for use in connection with rotating machinery of this sort shows a wonderful degree of ingenuity, it is undoubtedly complicated and in course of time is therefore likely to give trouble, which would be a very serious matter in the case of a large system. Much of the complication is eliminated if static converting apparatus is used, and the recent advances that have been made in the design of mercury-vapour rectifiers has brought into the field a formidable competitor of the rotary converter or motor generator for use in automatically-controlled sub-stations.

The Birmingham Corporation electricity supply undertaking has had a steel-cylinder mercury-vapour rectifier working successfully for about 18 months in the Harborne sub-station, during the last twelve months of which period it has been automatically controlled, supplying a l.p. d.c. lighting network, and it has proved to be quite satisfactory.

The rectifier is of the Brown, Boveri type of 230-kW capacity (500 amperes at 460 volts) and is connected to the outer busbars of the three-wire distribution system, the balancing being done by a battery of accumulators also installed in the sub-station, which also supplies the d.c. required for operating the various relays and switches. The rectifier transformer is supplied with 5,000-volt, 3-phase, 25-period current from the generating stations.

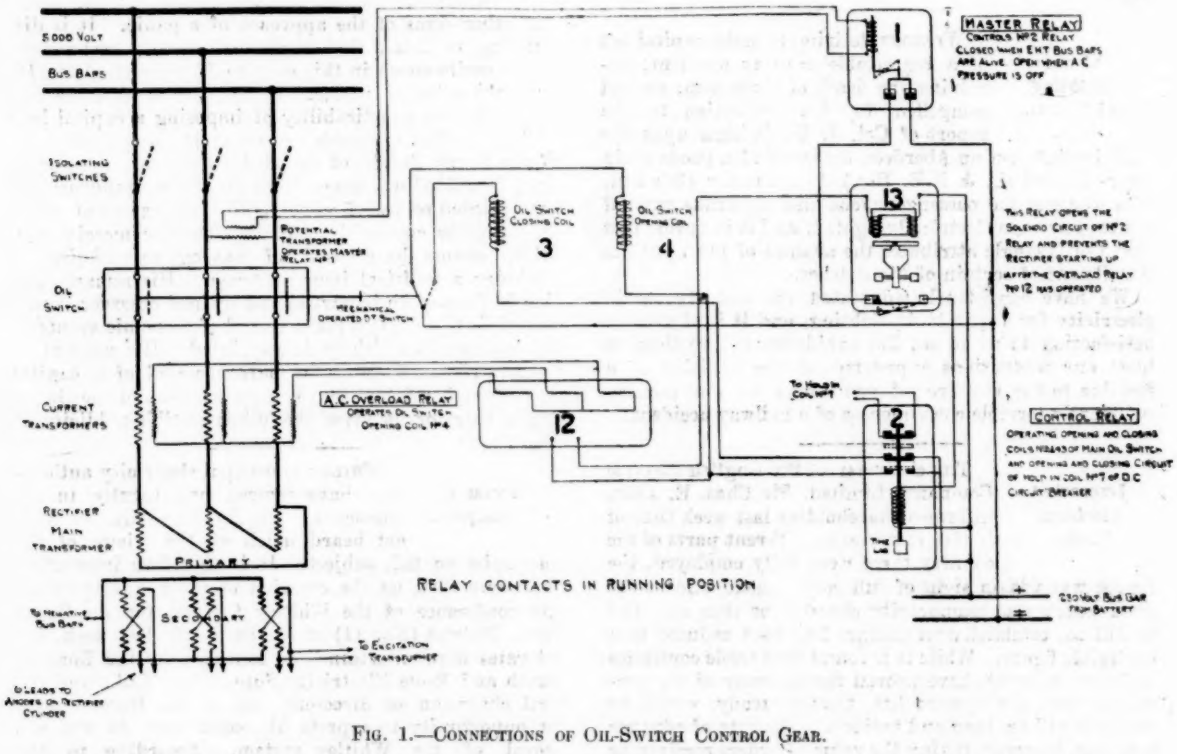

5000 Volt
Bus Bars
Isolating Switches
Potential Transformer Operates Master Relay No 1
Oil Switch
Mechanically Operated by Switch
Oil Switch Closing Coil
3
Oil Switch Opening Coil
4
Master Relay
Controls No 2 Relay
Closed when E.H.T. Bus Bars are Alive. Open when A.C. Pressure is off
1
13
This Relay opens the Solenoid Circuit of No 2 Relay and prevents the Rectifier starting up after the Overload Relay No 12 has operated
A.C. Overload Relay
Operates Oil Switch Opening Coil No 4
12
To Holding Coil No 1
2
Control Relay
Operating Opening and Closing Coils No 2 and 3 of Main Oil Switch and Opening and Closing Circuit of Volt-in Coil No 1 of D.C. Circuit Breaker
Current Transformers
Rectifier Main Transformer
Primary
Secondary
To Negative Bus Bars
To Excitation Transformer
To Leads to Anodes on Rectifier Cylinder
Relay Contacts in Running Position
+
−
230 Volt Bus Bar from Battery

Fig. 1.—Connections of Oil-Switch Control Gear.

To those who are not familiar with the operation of the Brown, Boveri rectifier, it will perhaps lead to a better understanding of the automatic gear which it is necessary to install if the usual method of putting the rectifier into service by hand is described first. Assuming that the vacuum in the rectifier cylinder has been properly formed by means of the small air pump and that the rectifier is ready for service, the e.h.p. a.c. oil switch is first closed and then the main step-down transformer is energised. The secondary winding of this transformer is arranged in six-phase, or double star, and is connected directly to the six main anodes of the rectifier, which are then made alive when the oil switch is closed.

A small a.c. to d.c. motor generator is next run up and connected to a solenoid which operates a steel plunger, also connected to the motor generator, which dips into the mercury bath cathode and strikes the ignition arc. After this arc has been struck, the rectifier commences to function, although still on open

circuit on the d.c. side. As the d.c. voltage of the rectifier is much higher on open circuit than it is when the device is delivering even a few amperes, it is necessary to stabilise this voltage by switching on a small load through a loading resistance until the rectifier is paralleled on to the d.c. busbars, when the loading resistance and the small motor generator can be switched out, the rectifier being left on the busbars to take up load.

The automatic apparatus installed at the Harborne sub-station performs the functions outlined above in their proper sequence, and with a suitable time lag between each operation. As soon as the e.h.p. busbars are energised, a single-phase potential transformer operates a "no-volt" type of relay which closes the d.c. trip circuit on to the main oil switch closing coil. The closing of the oil switch energises the main step-down transformer and also at the same time starts the air pump and the small a.c. to d.c. ignition motor generator mentioned above, fig. 1.

After an interval of about ten seconds, another relay comes into operation which closes the circuit between the motor generator and the ignition-arc solenoid, fig. 2. As soon as an arc has been struck inside the rectifier, a further relay de-energises the ignition relay and shuts down the motor generator set, whilst the voltage coil of the d.c. circuit breaker is energised. If the voltage of the rectifier is approximately equal to the voltage across the busbars, the circuit breaker now closes automatically and connects the rectifier to the supply mains, fig. 3.

If now an interruption of the main e.h.p. supply to the sub-station occurs, the "no-volt" relay will operate and open both the main oil switch and the d.c. breaker, thus disconnecting the rectifier completely on the a.c. and d.c. sides.

When the e.h.p. supply pressure is restored, the various relays operate in their normal sequence and re-connect the rectifier. In the event of a heavy overload or short circuit occurring on the transformer or

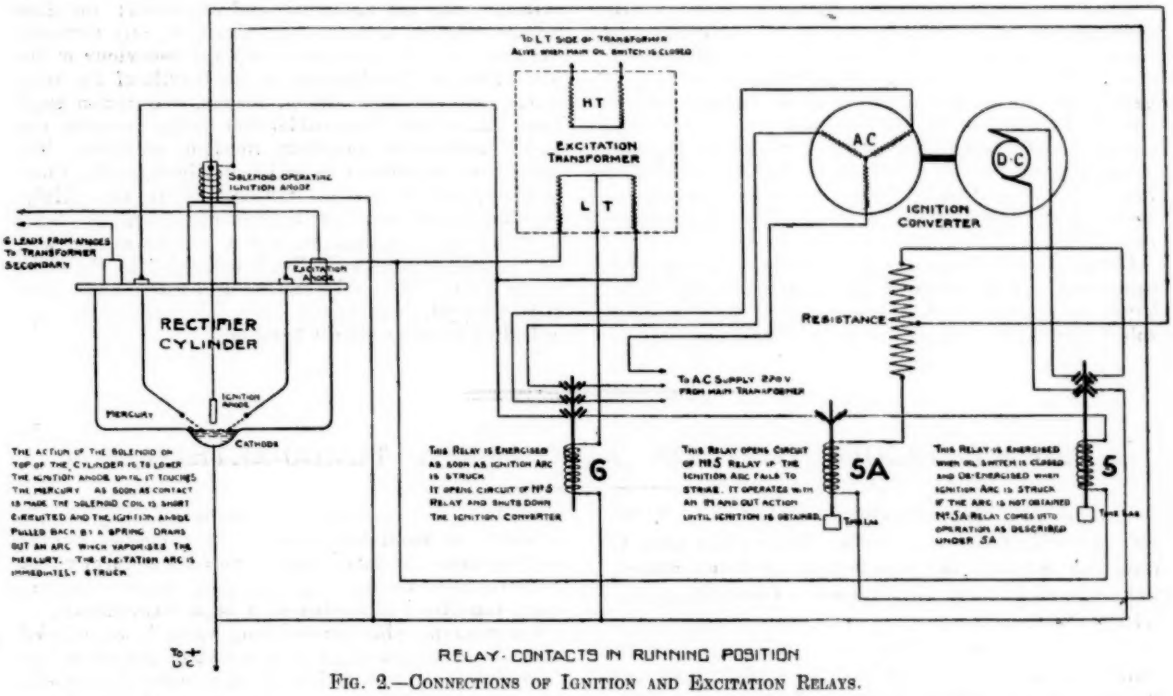


Fig. 2.—Connections of Ignition and Excitation Relays.

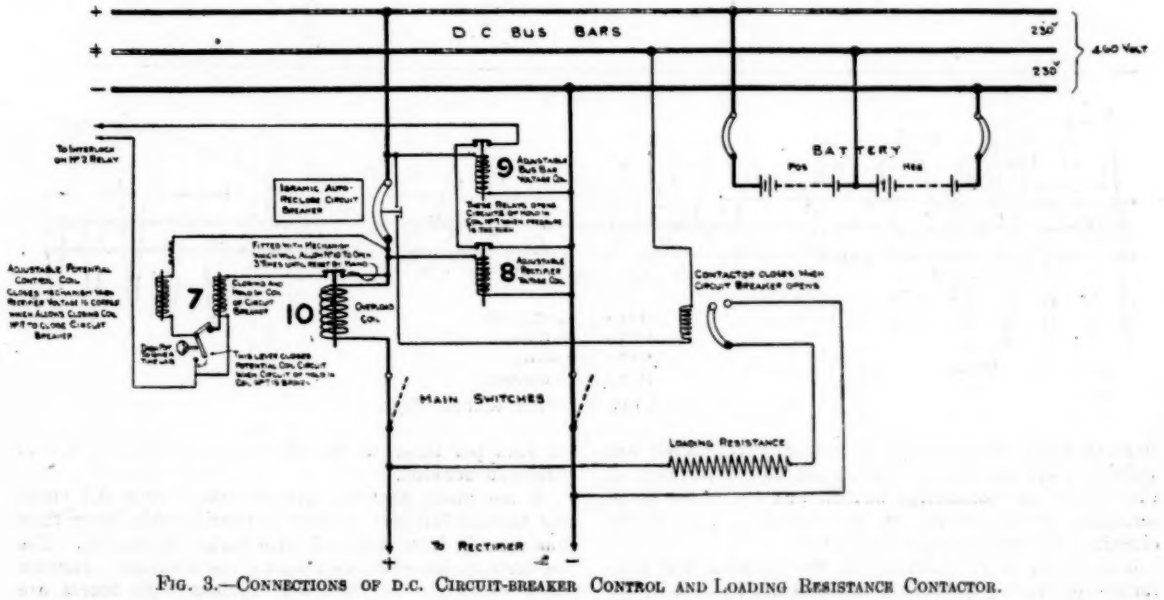


Fig. 3.—Connections of d.c. Circuit-breaker Control and Loading Resistance Contactor.

D

its connections, or an internal short circuit taking place in the rectifier due to loss of vacuum, the main a.c. overload relay will operate and disconnect the rectifier on both the a.c. and d.c. sides, and it is left out of circuit until this relay has been re-set by hand; the setting of the relay is so high that only a serious fault can operate it.

In the event of a heavy overload or short circuit occurring on the d.c. busbars to which the rectifier is connected, the overload d.c. circuit breaker will operate, and is capable of automatically reclosing on to the busbars three times only, after which it remains out of circuit until re-set by hand. Each time this d.c. circuit breaker opens, the loading resistance is automatically switched into circuit to maintain the d.c. voltage of the rectifier at the proper figure; similarly, when the d.c. circuit breaker closes again, the loading resistance is switched out of circuit.

Change-over switches are fitted so that the rectifier equipment can be operated either automatically or by hand, as desired, or by remote control from another sub-station. By means of pilot wires running to another and larger sub-station, the set can be started up or shut down at will, and signal or indicating lamps are connected to the pilot wires at the larger sub-station so that the men engaged there can tell if the automatic apparatus has operated correctly and if the rectifier is on circuit. The accompanying diagrams illustrate how the various relays, automatic switches, &c., are arranged and connected; for these we are indebted to Mr. R. A. Chattock, city electrical engineer, who is so satisfied with the behaviour of the plant (for the development of the details of the automatic gear of which Mr. G. Rogers, sub-station engineer, was largely responsible) that he has installed two 25-kW automatic glass-bulb Hewittic rectifiers. The latter have functioned so satisfactorily that Mr. Chattock proposes to develop the supply to the thinly-populated outlying districts of Birmingham by means of this type of apparatus, which will be so arranged that it will be automatically disconnected in the event of the e.h.p. a.c. supply failing and reconnected when it is restored, faults on the d.c. networks being controlled by fuses or circuit breakers.

A SHORT-CIRCUIT TEST ON A 40,000-kVA TURBO-ALTERNATOR.

An interesting test, subjecting a 40,000-kVA, 6,600-volt turbo-alternator to a sudden single-phase (line to line) short circuit, when running excited at full voltage, was made recently at the Rotherham Corporation electricity works, in the presence of Mr. Edward Cross, the engineer and manager. This machine is the largest set which has been constructed in this country, and was supplied by the British Thomson-Houston Co., Ltd., Rugby.

In order to carry out the test, the section of the busbars to which the machine is normally connected was isolated from the rest of the system on the far side of the busbar interconnecting switch, and two of the three terminals of this switch, on the far side, were short-circuited by heavy copper connectors.

The actual short-circuiting of the machine was performed by closing the busbar interconnecting switch, the main switch having been set to trip instantly on overload, thus making the conditions much more severe than when the time-lag device is used. In this manner a test was obtained, not only on the alternator, but also on the oil switch which was used, this being one of the well-known B.T.H. motor-operated (H6) type.

We understand that the switch cleared the fault in an extremely satisfactory manner, the only visible result being the throwing of a small quantity of oil, estimated at about half a pint. On a similar switch, used to make the short circuit, no oil was thrown and no parts were in any way damaged, despite the very severe conditions of closing on a dead short circuit.

The accompanying illustration, which is reproduced from the oscillogram, gives a complete record of the short-circuit current, which, at the moment of short circuit, rose to a maximum r.m.s. value of 18,200 amperes, *i.e.*, 5.2 times the normal rated current of the machine. This corresponds to a short-circuit reactance of 19.2 per cent., as usually expressed with regard to full-load current.

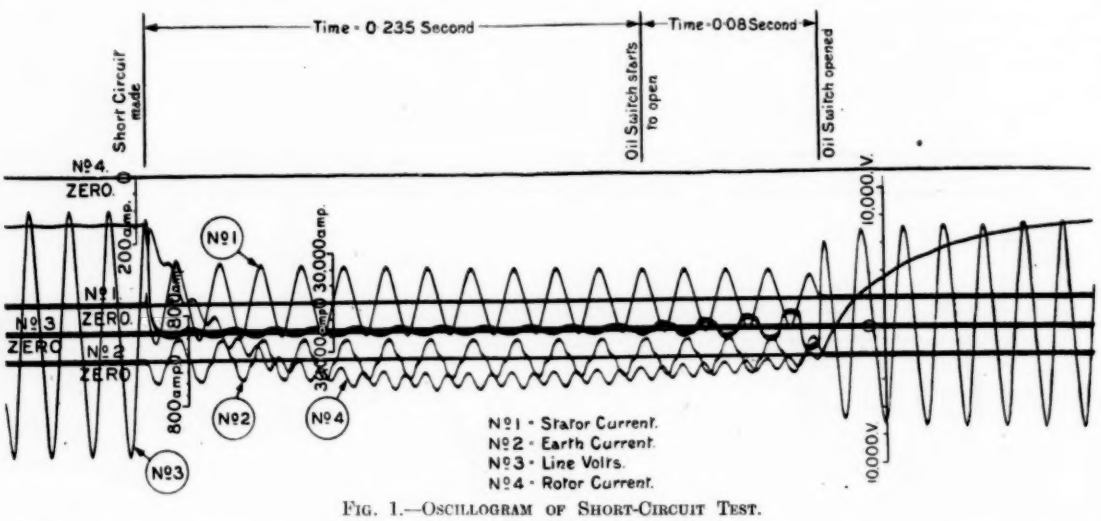


Fig. 1.—Oscillogram of Short-Circuit Test.

A maximum short-circuit current of only 5.2 times the normal full-load current is considerably lower than has usually been obtained with turbo-alternators. The advantage, however, of keeping the maximum current at a relatively low figure is obvious; the forces are correspondingly low, and, as is shown by this test, safety of operation is obtained even under the severe conditions of a short circuit on the busbars. However, in view of the size of the set under test, the forces were necessarily large, and it is very satisfactory to find that the whole of the installation, including turbine, alternator, cables, and switchgear, withstood the test without any signs of distress.

The oscillogram shows the stator current (curve No. 1), the earth current (curve No. 2), the line voltage (curve No. 3), and the rotor current (curve No. 4). The voltage, which, of course, falls practically to zero when the short circuit is applied, rises again to normal value after the fault has been cleared. It will be noticed that during the period of short circuit this curve assumes a constant ripple, the increase in amplitude at the end of this period indicating the point at which the contacts of the switch commence to separate. The increase in amplitude of this curve continues from this point until the switch breaks the circuit completely, when the curve again rises to normal values.

The small amplitude of curve No. 2, the current flowing through the neutral connection of the machine, is due to the current-limiting resistance through which the neutral point is connected to earth.

Although the machine was subjected to a single-phase short circuit, it is interesting to note, in curve No. 1, how closely the alternator current approximates to a sine wave, the usual distortion of the current wave under short circuit being largely eliminated by the efficient squirrel-cage windings on the rotor; the effect, however, of the heavy short circuit can be seen in the small double-frequency ripple which appears in the rotor current curve (No. 4).

The timing of the oscillogram shows that the operation of the overload trip of the switch was effective in rupturing the current at the end of 16 cycles, that is, after approximately one-third of a second.

CENTRAL EUROPEAN ELECTRICAL EXPANSION.

(By a Special Correspondent at Prague.)

Czecho-Slovakia.

The water power of Czecho-Slovakia is unequally divided between Bohemia and Moravia, the former having an estimated 1,658 million and the latter 162 million kWh per annum. To this, however, must be added Silesia and Slovakia, the latter having water-power resources almost unlimited. In view of the shortage of coal and petroleum, it is intended to make the utmost use of these. The amount of electrical energy required annually, exclusive of the needs of the railways, is about 2,500,000,000 kW-hours, a demand at present met by 345 separate electrical concerns intended for the public supply, in addition to a considerable number of power stations which supply private owners. Hereafter, the energy is to be supplied by a uniform system at 22,000 and 100,000 volts, the current being generated in the coal districts by nine thermo-electric power stations, of which the largest three will be set up at Duchcov (Dux), Bohemia; Moravská-Ostrava, Moravia, and in Slovakia, while additional water-power stations will be installed on all the principal rivers in the Republic. It is intended to take over all the utilisation of water power and construction of water-power plants.

Indeed, a complete change has taken place in the electrical industries and enterprises of Czecho-Slovakia, a new law having been brought in establishing Government utilisation of water power and construction of water-power plants. While private enterprise will be encouraged, it will be subject to State domination. Already a large number of established concerns have submitted to the new regulation, the State now holding a considerable—and, indeed, preponderating—interest in the following concerns:—The Central Bohemian Electrical Works, Prague-Karlín; the Electrical Union of the Central Elbe Area, Kolin; the West Bohemia Electrical Union, Pizen; and the Electrical Union of the Northern Sumavá Area, Tachov, as well as the recently-established South Bohemian Electrical Works, Ceské Budêjovice; the Moravian-Silesian Electrical Works, Moravská-Ostrava; the Electrical Works of Northern Moravia Sternberg; the Electrical Works of Central Slovakia, Bánská Bystrice and "Iskra," Holic. The whole of these companies, together with others in course of formation, will hereafter carry out the electrification of the country with the help of the State and local authorities.

The estimated cost of the complete electrification of the Czecho-Slovakian system will amount to over 2,000 million crowns for the construction of hydro-electric plants, and 500 million crowns for electric plants driven by steam power. The building of the thermo-electric power stations and the system of mains is spread over 20 years, and the construction of the water-power stations over 50 years.

The Government has joined with the Administrative Committee for Bohemia, the City of Prague, and the Central Bohemian Electric Works for the erection of electricity works in Seestadtl, a company having been formed with a capital of 30 million crowns, divided into 60,000 shares of 500 crowns, to carry out the project. The works will be located near the Hedwig coalfield in Seestadtl, and will have a central distributing station in Prague transmitting power to Middle and Northern Bohemia. A proposition supported by the Slovak General Credit Bank is under consideration for the electrification of Russinia, in Carpathian Ruthenia. In view of the great richness of the country in water power, substantial success is hoped for in connection with this enterprise. In addition, the erection of a new plant has been planned at Huszt, also in Russinia (Ruthenia). This project calls for a canal to connect the Tereblje (Talabor) and Velka Reka (Magyag) Rivers, both of which have their sources in Russinia. The power expected to be developed has been placed at 45,000 h.p. While there can be no question as to the feasibility of the plan, geological tests and surveys having demonstrated this sufficiently clearly, the great problem is to find the capital to finance the undertaking. Undoubtedly its realisation would permit of the development on a large scale of the rich forest and mineral resources of Russinia, and prove of inestimable economic benefit not only to that part of Czecho-Slovakia, but to adjoining sections of Hungary and Rumania as well.

Radio-telephony has not yet passed the stage of infancy in Czecho-Slovakia, and in order to introduce communication by this means a special commission of experts is now studying the progress made in other countries. Upon the findings and recommendations of this commission the future of radio-communication in Czecho-Slovakia depends. Many local factories are interested, and await but a favourable moment for producing the necessary requirements of the industry.

Messages from Czecho-Slovakia to the United States, *via* France or Germany, can now be sent at 16.8 Czecho-Slovakian crowns (the rate varying with the fluctuations in the rate of exchange) per word, as the result of an agreement concluded between the Telegraph Administrations of France and Czecho-Slovakia. This means a reduction of 23 per cent. as compared with the rate *via* Marconi. These rates are only in force for traffic to the United States; messages filed there for transmission *via* radio are sent *via* London at 35 cents per word, which is the same as the rate hitherto prevailing.

Austria.

Electrical manufacturing is one of the most important industries in Austria; considering the probable future developments of the new Republic's water power and the electrification of its railways, exceptionally bright prospects for the future are said to exist. While many of the necessary raw materials—such as

rubber, copper, certain textiles, and part of the porcelain employed—have to be imported, 70 per cent. of Austria's electrical manufactures are exported. The estimated manufacturing plants (including power apparatus, telephone and telegraph equipment, electric lamps, wire and cable) represent normally a value of 88 million crowns (gold); a power of 7,200 h.p., and employment, when in full operation, for 25,000 men. At present, however, unemployment exists to a considerable degree.

In view of the fast-improving financial position of the country, the electrical companies expect soon to be well supplied with orders; with the exception of the wire and cable factories, most plants will shortly be again working, it is thought, at something like full capacity. Unfortunately, however, Austria has to meet severe competition from Germany, and this has become additionally serious on account of the fall in the currency. Teutonic electrical machinery is being offered not only in Austria, but in Yugo-Slavia, Hungary, and the Balkan States in larger and larger quantities and at lower and lower prices, far below the figure at which the Austrian factories can work. Such firms as the A.E.G., Siemens-Schückert, and Brown, Boveri et Cie., have made common interests with German firms, and are, therefore, not so greatly affected by this competition as are some Austrian companies. This also applies to the sale of meters and measuring instruments, the manufacture of which has fallen off by at least 40 per cent. on account of keen German competition. About 60 per cent. of the production of the Austrian telephone and telegraph factories is taken by the States, the remainder being sold at home and abroad to private customers. The factories turning out lamps have at present a large number of orders in hand. These establishments belong to an international association regulating the marketing of electric lamps.

The principal classes of electrical goods imported by Austria comprise dynamos and electric motors (except automobile motors); meters, &c.; switches, contacts, &c.; electric lamp bulbs, &c.; other electrical apparatus; cables and insulated wires, and carbon for electro-technical purposes. The exports comprise dynamos, electric motors (except automobile motors) and transformers, telephones and microphones, switches and contacts, electric lamp bulbs, accumulators with plates of lead and plates alone, and carbons for electro-technical purposes.

Electrification of the Austrian railways is making great headway. The line over the Arlberg and Vararlberg is already well advanced. The first electric locomotive was recently received and run over the lines between Vienna and Hainburg. Electrification of the line between Innsbrück and Bludenz, and between Innsbrück and Landeck, is to be completed by the middle of next year (1924). It is expected that in the first half of that year the Salz-Kammagut line may be ready for use. During the course of last summer power-plant construction on the Mallnitz also made considerable progress.

A municipal tax of 1½ per cent. on gas consumption and 4 per cent. on electric light has recently been imposed for the purpose of financing the work of electrification on the Ybbs, undertaken by the Commune of Vienna. The tax is expected to yield 1,750,000 crowns per month, and to equal the monthly sum expended upon the Ybbs project with regard to wages and material.

Hungary.

Hungary is also devoting considerable attention, and as much State capital as can be spared, to electrical construction and extensions. Trunk railways radiating from Budapest are being considered for electrification, and a 15-kilometre experimental section is soon to be taken in hand. Present traffic conditions indicate the necessity for speedy electrification of Hungarian railways. While no decision has yet been arrived at, there seems little doubt that ultimately the Government will have to electrify all trunk lines radiating from Budapest, a total of 1,400 km., or 2,000 km. including double tracks. The question remains open, however, with regard to the particular system of electrification to be adopted. But a new split-phase system, somewhat similar to that of the Norfolk and Western Elkhorn (U.S.A.) Railway, will be given a trial. An experimental run has already been made on a short line of about 15 km., equipped with overhead construction. The test was not found altogether satisfactory, and another trial will be undertaken during this year and thereafter a definite decision arrived at. General electrification of the country's railway system will be pushed on as rapidly as financial and labour conditions permit.

Among such undertakings favoured by the Administration of the Hungarian State Railways is the transformation of the superstructure on a line of 15 kms. of railway between Budapest, Dunakeszi, and Alag. Originally the work was to have been completed and opened in May of this year (1923). The electric locomotives will be the same size as the ordinary steam locomotive, the first of these engines having been manufactured by the Ganz-Danubius and the Ganz Electrical Companies. It is of some interest to note that in constructing these locomotives an invention of the company's manager is being applied, whereby the machine runs at equal speed whether up or down grade. The maximum speed of the motor is about 67 km. per hour; both passenger and freight trains are hauled at this rate. The speed of locomotives driven by steam changes continually according to the grade of the line, and, on account of the inferior quality of the coal used, the maximum speed of even the fast trains in Hungary does not exceed 40 km. per hour. The advantage of the system referred to is, therefore, obvious. At the present rate the cost of producing an electric locomotive in Hungary is 25 million crowns, this being the price estimated by the Ganz-Danubius Co.

MARINE ELECTRICAL MACHINERY.

(Communicated.)

With the increasing use of electrical auxiliaries for marine work, an added responsibility has been placed on the marine engineer. He being a conservative class of engineer, new things find but slowly a place in his esteem.

At the present time he is fully occupied with problems arising from the use of double-reduction gears in conjunction with high-speed turbines. Judging by the controversial papers recently published on the subject, there seems to be no settled opinion even upon the advisability of using such gears, and many failures have induced some shipowners to revert to the relatively inefficient reciprocating engine with its magnificent record of reliability. It is perhaps unfortunate therefore that the growing use of Diesel-engined ships with their electrical auxiliaries should synchronise with this situation.

It would appear that another rating is desirable in the engine room. A few shipowners have recognised this, and have appointed one and sometimes two electricians per ship to serve as watch-keeping engineers. The ordinary training of the seagoing engineer does not fit him for the supervision and maintenance of electrical machinery and switchgear, and strange stories could be told of extraordinary occurrences in the engine room, resulting from such engineers tackling electrical problems.

The time is now ripe for the Board of Trade to formulate new regulations for the examination of engineers.

In land practice an entirely new class of engineer has been evolved to meet the requirements of our various power supplies. To the writer the present marine practice does not appear good. In vessels not carrying any trained electrical man, maintenance charges are high and breakdowns invited.

Where electricians are carried there is at present no opportunity for promotion to the ranks of second or chief engineer, and therefore the best type of man is not attracted. The best solution therefore seems to be to train the marine engineer.

For the sake of the safety of ships at sea as well as of economical running, marine engineers should receive an electrical training either during or at the end of their mechanical training. It is preferable to have the watch-keeping engineer trained in electrical work rather than to have a separate rating. The latter method is expensive, and involves dual control, which, sooner or later, leads to trouble and inefficient working.

The position may be put thus briefly:—

Ships have to be run at a profit.

Electrical auxiliaries have demonstrated their efficiency, but if they are to be retained they must show reliability equal to that of the steam auxiliary. If neglected or misused, they will break down.

A breakdown in the case of the steering gear places the ship out of control, with the consequent danger of total loss.

Marine machinery runs at full power 24 hours out of 24, and under conditions of environment not usually considered conducive to long life.

The gear must therefore be attended by specially competent engineers trained under some such scheme as is outlined above. Under these conditions electrical machinery will come to be used in every class of ship sailing the seas.

THE ORGANISATION OF THE ELECTRICAL INDUSTRY.

The Contractors Evolve a New Trading Policy.

AT the annual dinner of the Electrical Contractors' Association (Inc.), Mr. Howard Marryat, the president, in a speech reported in our last issue (p. 653) announced that on that day (April 24th) the Association had issued a declaration of its trading policy. The new policy was the outcome of six months' close deliberation by a Special Committee, and it was hoped that the proposals would commend themselves as reasonable.

We are enabled to place the full details of the scheme before our readers to-day in the following reprint of the complete report of the Special Policy Committee, and we allude to the subject in our leader pages:—

Report of Special Policy Committee.

A Special Committee, to formulate a Trading Policy to be followed by the N.E.C.T.A., Ltd., in order to realise the ideals of the Electrical Contractors' Association, was appointed by the Council on October 16th, 1922, composed of:—

Mr. H. Marryat, M.I.E.E., president.
Mr. W. R. Rawlings, A.M.I.E.E., past president.
Mr. W. Cross, M.I.E.E., past president.
Mr. P. Collinson, past president.
Mr. H. J. Cash, M.I.E.E., past president.
Mr. J. Orringe, A.M.I.E.E., past president.
Mr. W. Riggs, A.M.I.E.E., chairman of the Trading Committee.

The composition of the Committee was made with especial regard to the nature and importance of the reference.

The Committee has held five whole-day sessions which all members have attended, and it has devoted extreme care in the consideration of the reference and the framing of this report. A great deal of work in the consideration of matters brought before the Committee and in the framing of clauses has been carried out by individual members between the regular meetings.

The Committee finds that there is a general feeling expressed in the Press and at meetings of electrical men that the industry is not as well organised as it should be, especially with regard to the method of distribution to the user, and that some improved relationship between the manufacturing, wholesaling, and retailing sections of the industry must be set up if the best results are to be achieved. The Committee has therefore, in outlining a trading policy to guide the Association, earnestly set itself the task of laying a basis upon which such an improved relationship may be built.

The recommendations which are now made must be considered in the nature of a compass rather than a chart. They are intended to direct and guide without binding. It is not suggested that the Electrical Contractors' Association should dictate to other sections of the industry, but that in its relations with these it should consistently follow a policy which it believes is in the best interests of all concerned.

The great business organisations of this and other countries have already realised the fundamental principle that success and the satisfaction of the public depend upon the maintenance of a healthy and prosperous body of retailers, and that unless trading conditions are such as to encourage brains and money into the retail field, the reproach which has so often been hurled at the electrical contractor must continue, and a great deal of costly research, development, and advertising of the electricity suppliers and manufacturers be sterile.

Care has been taken to guard against recommending privileges for the electrical contractor which would be unacceptable to other sections of the industry, as such recommendations would defeat their own object. To this end the Committee has consulted a number of gentlemen prominent in manufacturing and wholesaling, who have volunteered their assistance and have spoken freely their personal opinion upon each point raised. The recommendations now made have been drafted so as to receive the general support of all these witnesses.

In the course of this evidence it was made clear that both manufacturers and wholesalers generally would welcome the policy which is now outlined, which is calculated to create a large and thoroughly substantial retail section of the industry.

The Committee does not propose that its recommendations can be carried into effect immediately nor, as regards some of them, for a long time perhaps, but it considers that the policy now formulated should be followed consistently and so far as is possible, in the making of all trading agreements.

As trading matters are interlocked to a certain degree with all other activities of the Association, this report should be in the hands of all chairmen for their guidance.

Recommendations.

The broad principle of the Association in trading is, by co-operation or otherwise, to establish its membership in a sound position commercially and financially and so that it can control the details of its own business without undue interference from any other section of the trade. To arrive at this end it is recommended that:—

1. The Association must aim at obtaining such share of the control of the electrical retail trade as will ensure that all regulation of the conditions of retail electrical trading is carried out with the collaboration and consent of the Association.

2. The Association in its trading policy should aim at improving conditions of the retail trade generally. To effect this end the Association must aim at strengthening its own membership and position by obtaining special benefits for its membership.

3. It shall be an object of the Association to reduce the costs to the users with a view to increasing the turnover of the industry. It therefore follows that:—
   (*a*) The intervention of the middleman between the manufacturer and the contractor or retailer must be eliminated, except in the case of such wholesalers as do genuinely reduce distributing costs by carrying a substantial stock and supporting the manufacturer by large contract buying.
   (*b*) Contractors and retailers shall reduce costs by buying in quantity.

4. It shall be an object of the Association—
   (*a*) That its members shall undertake the running of retail showrooms, and generally the introduction to the user of new inventions and designs.
   (*b*) That as this policy (4*a*) progresses, manufacturers and wholesalers shall be discouraged from direct trading with the users until eventually they shall do no more than advertise their goods to the user under a trade name, so creating a demand which can be supplied by contractors and retailers.

5. As it is in the interest of the industry that the manufacturer and wholesaler shall not in any way trespass upon the business of the contractor or retailer by supplying to the user, therefore—
   (*a*) The immediate policy of the Association shall be to limit as much as possible the conditions under which wholesalers and manufacturers may supply direct to the user; and
   (*b*) Where the Association agrees, *pro tem.*, to the manufacturer or wholesaler supplying direct to the user, it shall be upon the condition that the price is such as would allow a retailer to execute the order on the same terms while reserving for his services a reasonable margin of profit.

6. The Association should support any moderate scheme of price maintenance put forward by the manufacturers.

7. It shall be an object of the Association to secure the general principle of discount upon quantity buying, in addition to a trade discount reserved exclusively for resellers, so as to eliminate the wasteful expense attached to small parcel buying. Quantity discount can be based upon—

(*a*) Quantity of any single order, and

(*b*) Quantity taken in a stated period.

This Committee recommends the adoption of a large discount under (*a*) as compared with a smaller discount under (*b*).

8. The Association shall, in framing its policy, aim at attracting capital and the best men to the contracting and retailing side of the industry.

9. It shall be an object of the Association to secure from manufacturers and wholesalers cash discounts upon all purchases on a strict basis of prompt payment.

10. In order to achieve the objects of the Association, and with special regard to clauses 4 and 5, it will be necessary that its members shall not, as manufacturers and wholesalers, enter into competition with the manufacturers or wholesalers.

Certain contractors manufacture in some form, and it is not found possible to draw the line exactly at what is legitimately part of their contracting business. There should be no interference with such manufacturing, except that where manufacturers complain of competition arising in this way the Association should give the complaint careful hearing, and, if necessary, instruct its member to establish his manufacturing business as an entirely separate concern.

The Association should adopt a similar attitude with regard to contractors who compete with wholesalers.

11. It shall be an object of the Association to co-operate in any approved scheme for educating the public to appreciate the best and most satisfactory electrical installation work and apparatus.

12. The Association defines "electrical wholesaler" and the difference between "wholesale trade" and "retail trade" as follows:—

"*Electrical Wholesaler.*"—Any person, persons, company, corporation or firm, who, being in business on his or their own account, has business premises and equipment and carries substantial stocks of electrical goods for resale to electrical contractors and retailers, and does not carry on contracting work or a retail trade.

"*Wholesale Trade.*"—Comprises all transactions in the supply to electrical contractors, retailers, Government Departments, and such other bodies as may be scheduled by agreement, of all electrical plant and materials.

"*Retail Trade.*"—Retail trade comprises all transactions in the supply direct to the user of all electrical plant and materials, excepting such as may from time to time be the subject of agreement between the manufacturing, wholesale, and retail sections of the trade.

13. It shall be an object of the Association that the term "trade user" shall be defined in agreements under the exceptions provided for in the definition of "retail trade," and that such "trade users" shall secure and be entitled to quantity discount only.

14. A fresh section of the Association shall be formed to provide for electrical retailers, and these should participate in retailers' trading advantages secured by the Association for its membership.

As an object of the Association is to make it necessary for every retailer to become a member, there will eventually be found wishing to join those who are already connected with other electrical or trading associations with whom the N.E.C.T.A., Ltd., may be in negotiation. Provision must be made for these, although it may be necessary to exclude such members from participating in any vote upon policy.

15. The Association defines "electrical contractor" and "electrical retailer" as follows:—

"*Electrical Contractor.*"—A person, firm or company having business premises and equipment who carries a stock of electrical goods and sells to the user and who installs electrical apparatus under the supervision of a person qualified for any of the following:—

(*a*) Registration as an electrical contractor as defined by the National Registration Authority for Electrical Contractors.

(*b*) Membership or Associate Membership of the Institution of Electrical Engineers.

(*c*) Membership of the E.C.A.

"*Electrical Retailer.*"—A person, firm or company with shop or showroom premises and equipment suitable for a retail trade, or equivalent facilities for resale, who carries a substantial and varied stock of electrical goods and sells the same to the user.

Although the two businesses are very commonly combined, they are not really identical; and whilst it is generally desirable that an electrical contractor should also be an electrical retailer, there are, and always will be, a large number of electrical retailers who are not electrical contractors, and would gain no advantage by combining that business with their own.

16. The Association shall support British industry and give preference in its agreements to British manufacturers and wholesalers of British goods.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY FOR MARCH, 1923.

The March returns of electrical export and import business show, as regards the exports, a slight improvement (£12,975 increase) as compared with February, but a decrease of £165,129 as compared with March, 1922, the principal falling off occurring in the electrical machinery section, which is £200,000 down as compared with the corresponding month last year. Lower values were also recorded in the following sections: Telephone and telegraph instruments and apparatus, electric glow and arc lamps, electrical instruments, and electrical goods and apparatus (unenumerated).

The electrical export figures for the first three months of 1922 and 1923 are:—

	1922.	1923.
Electrical goods and apparatus	£2,040,443	£2,066,313
Electrical machinery	1,436,394	1,015,716
Total for first three months	£3,476,837	£3,082,029

The total weights of electrical machinery exported during the first three months of 1922 and 1923 were 5,271 and 4,910 tons respectively.

Electrical imports for March totalled £225,653, a falling off of £19,901 as compared with February, and £26,368 less than in March, 1922. Again it is in the electrical machinery section that the principal decrease occurs.

The re-export figures of electrical goods, &c., and machinery at £16,370 show a falling off of £456 as compared with the February totals, and of £3,404 compared with March, 1922.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Mar., 1923.	Inc. or dec. as compared with Feb., 1923.	Inc. or dec. as compared with Mar., 1922.	Electrical imports for Mar., 1923.	Inc. or dec. as compared with Feb., 1923.	Inc. or dec. as compared with Mar., 1922.	Electrical re-exports for Mar., 1923.	Inc. or dec. as compared with Feb., 1923.	Inc. or dec. as compared with Mar., 1922.
Electrical goods and apparatus (unenumerated)	£111,770	+£26,578	− £1,803	£52,368	− £1,470	+ £5,139	£2,892	−£248	−£1,929
Insulated wires and cables ...	175,574	− 10,160	+ 28,537	16,791	− 4,160	− 2,666	58	− 40	− 666
Glow lamps	20,795	− 5,411	− 17,554	13,643	−12,162	+ 2,096	860	+238	− 8,203
Arc lamps and parts	1,105	+ 805	− 1,259	1,597	+ 615	+ 516	—	—	—
Batteries and accumulators ...	48,934	+ 1,766	+ 1,414	11,591	+ 2,281	+ 2,921	—	−335	− 5
Meters and instruments ...	21,324	− 10,035	− 12,423	7,462	− 3,189	+ 3,788	130	−250	− 442
Carbons	7,183	+ 3,694	+ 3,681	2,368	− 2,203	− 2,789	65	−501	− 44
Electrical Machinery—									
Electrical machinery (unenumerated)	133,939	+ 9,787	− 51,171	82,037	− 2,049	−54,474	10,910	+345	+ 8,812
Railway and tramway motors	21,663	− 6,507	− 891	—	—	—	—	—	—
Other motors and generators ...	140,922	+ 8,954	−136,529	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	3,934	− 3,604	− 11,567	40	+ 40	− 374	30	+ 30	+ 30
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cables (not submarine)	98,476	+ 31,476	+ 68,637	4,677	− 1,814	− 141	4	+ 4	− 1,182
Submarine telegraph and telephone cable	47,281	+ 20,007	+ 29,508	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	116,557	− 54,375	− 63,709	33,079	+ 4,210	−19,616	1,421	+301	+ 225
Totals	£949,457	+£12,975	−£165,129	£225,653	−£19,901	−£26,368	£16,370	−£456	−£3,404

CORRESPONDENCE.

Letters received by us* after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Cleanliness in Wiring.

With reference to your leaderette "A Break with Tradition," you may be interested to hear of one contractor, at least, who "shows willing"—to the extent of supplying rubber-soled shoes. To have men change into these, on a muddy day, I consider is a great advantage to the customer (and his staff!). For dust sheets we rely upon the house; bread crumbs or a wet handkerchief clean the paint, while the dust-pan and brush are never far away.

This care in carrying out the work, together with the "straightening-up" of rooms every evening is, I find, a consideration which my customers appreciate and which more than pays for itself.

P. M. Braidwood.

New Barnet,
April 28th, 1923.

Under the heading "A Break with Tradition" in your issue of April 27th you publish an extract from *Electrical Merchandising*, describing the cleanly methods of a New York contractor, and you state: "We can hardly hope that British electrical contractors will go so far to study the convenience of their clients, &c." Now, I simply wish to point out that most firms of good standing in Scotland have studied their clients in this respect for years. It is a recognised rule with the employés of my present firm, Messrs. Ponsford and MacHardy, Ltd., of Dundee, Broughty Ferry, and Arbroath, that on all house jobs, soft house slippers are worn. We always use dust sheets to catch any plaster, and the youngest apprentice on the job is kept busy all day with a brush and dust pan. If the house is occupied while the job is proceeding, every room is left habitable at night. On numerous jobs which I have supervised I have been told on completion that our clients hardly knew we had been in the house at all. Cleanliness is a good habit, easily learned, and it speeds up the job. If you have no rubbish lying about, you don't have to dodge it. Our New York friend's only innovation is the white overalls and cap, and I am afraid the fashion will have to stay with its originator, as we have no desire on this side to look like chefs or bakers.

Alexander Findlay.

Arbroath, *April 28th*, 1923.

[We congratulate our correspondents on their excellent methods, and commend their example to our other wiring readers.—Eds. Elec. Rev.]

The Wireless "Monopoly."

I am taking advantage of the Editors' kindness for the use of this space to answer collectively various points which have been missed with reference to the article, under the above heading, in the Electrical Review, of April 20th.

There seems to be a misapprehension regarding the patents which members of the B.B.C. are entitled to use, and I think I am right in stating that Marconi's and other companies are now charging a much smaller royalty than would have been the case had the B.B.C. not been formed; the manufacturers will find it very difficult to make efficient wireless sets without infringing these patent rights, and more difficult to sell sets if the royalties are increased.

It is quite obvious that the trade which has been done in wireless apparatus has been created by the nightly broadcasting, and traders as well as the public should contribute towards the cost of such broadcasting, which, on the one hand, has given employment and fair profits, and on the other, much pleasure.

The "monopoly" which exists is simply that the B.B.C. is an independent company formed for broadcasting, and should, and could, be joined by every manufacturer (no manufacturer has ever been refused admission).

If broadcasting instead of being controlled by the B.B.C. is thrown open to all and sundry, and central control removed, there will be absolute chaos, one firm competing with another in its own interest without considering the public in the slightest degree. In this connection it is very interesting to note that the latest reports from America show that the system of haphazard transmission has brought disrepute on the whole broadcasting scheme, and the latest recommendations are towards centralised control.

This want of control is what everyone connected with the early stages of broadcasting tried to avoid in this country, and did so effectively, and there is no doubt that American methods were well studied before the B.B.C. was formed, with the result that America is now thinking of copying our methods—having had more than enough "Freedom of the Air" which in theory is excellent, and in practice a failure.

It has been overlooked that there are firms in this country which did early pioneer work, and spent thousands of pounds per year in research work, which has made broadcasting possible; and surely these firms, which have done this spade work, and risked failure, should receive the benefit of their success, more especially as they have been generous enough to give the results of their research to any manufacturer for a reasonable royalty. The B.B.C. scheme may be imperfect (it has been so many years established!) but it does give a certain return to long-sighted manufacturers, and a good, and still improving, service to the public.

It has been suggested that the 4,000 (?) manufacturers who have not joined the B.B.C. have been treated very badly, and have found great difficulty in selling their wares.

In reply to this, I would remind these manufacturers that if it had not been for the B.B.C. they would not have had anything to sell, but they have been carried along on the wave of success created by advertising by the members of the B.B.C. Also, a number of these manufacturers have had no previous knowledge of the electrical trade, but sprung up like "mushrooms in a night" when wireless became popular, and are just as ready to forsake the wireless industry for any other boom, whether electrical or otherwise, provided there is a possibility of quick returns; also they have hit the legitimate electrical contractor very hard by advertising directly to the public at prices which make no provision for the trade.

Much has been made of my statement that if restrictions were removed, the market would be flooded with foreign material, and I am told that Headphones (the biggest offender) comes under the "Key Industry Act." This is not so; only the permanent magnets come under this Act, these being taxed 33⅓ per cent., which amounts approximately to the enormous sum of 2d. per receiver.

A programme was provided on Thursday night, April 26th, by arrangement with one of the large stores, and this has been commented on, and compared with the usual nightly B.B.C. concerts. This, in my opinion, is very unfair. No doubt several commercial houses are willing to give first-class entertainments as an advertising medium, but are they prepared to give such concerts on three hundred and sixty-five days of the year?

I am constantly being reminded of the "Freedom of the Air," and I have a hazy notion that I have heard or read somewhere the possibility of free insurance, but what I am waiting to hear is the freedom of the Press news, and the restrictions removed to allow the B.B.C. to broadcast news before 7 p.m.

However, a committee has been appointed to decide all these issues, and as I believe most wireless enthusiasts are young men, another year or two's loss of business will be immaterial to them.

The Postmaster-General is no doubt actuated by the best possible motives in suggesting a third licence for amateurs to build their sets for a very small fee, and the trade generally is thoroughly in agreement with him. On the other hand, the directors of the B.B.C. have the interests of their shareholders to study, and they should be able to estimate very accurately their working costs. Therefore, if the amount suggested as the B.B.C. portion is not sufficient to cover expenses, it would be a suicidal policy for the company to agree.

There are many thousand applicants for licences for home-made sets—the majority of the applicants have no technical knowledge, and very few of them have built their own sets, but have bought manufactured parts and assembled them; and anticipating the sales which will follow the issue of the third licence, certain makers are now offering parts to build wireless receiving sets. This building in most cases consists of screwing the fully-made parts together, and running the necessary wires according to a diagram supplied.

W. C. Jeary.

London, *April 28th*, 1923.

Gas v. Electricity.

If public health in our large cities is to be improved, the principal and all-important factors achieving this desirable end must be credited to electricity and gas. It is an indisputable fact, with few exceptions, that both electricity and gas could render all services that are necessary for industrial and domestic requirements. The question is sometimes asked: "What prevents such a desirable state of affairs from coming into being?" and the only answer that can be given is that apathy and jealousy sprag the wheels of progress.

Your article leaves no one in doubt as to what you mean. You want a clean atmosphere: pure air and all the sunshine that is possible without impairment. It is impossible to discuss, far less solve, such a problem without fully considering the economic aspect so far as we know it, and it is when this side of the question emerges that the electrical and gas experts differ.

Suppose someone were to ask what the result would be if all industrial and domestic fires, including the gas works, were put out of commission. Would we then be free from smoke and poisonous fumes in the air we breathe? The answer would be, if the truth were told, that as long as we allowed as at present the smoke and gases from 80 to 90 tons of coal out of every 100 tons consumed to be wasted in ash, smoke, gases and hot water, conditions would not be greatly improved.

Now suppose we ask the same question about the manufacture of gas. The answer would be that 75 per cent. of the

coal carbonised produced gas, coke, and manifold by-products, the 25 per cent. balance being part used to carbonise the coal in retorts and generate steam, the remainder being lost in various stages of manufacture; further, no smoke at any time is, except by accident, allowed to escape and pollute the air and shut out the sunlight. Were this the only aspect of electricity *v.* gas, the logical thing to do would be to put the electricity station out of commission, but of course such action would be ridiculous. Electricity has unlimited scope and ground to traverse.

Why squabble over the question of domestic heating and cooking? Electricity cannot at present compete on an economic basis, while it at the same time neglects potential power requirements through lack of forethought in not offering assistance to industrial users.

Are you justified in saying that thermal units and, I will add, efficiency are fallacious comparisons? and if so what other standard would you suggest? Can you dispute that out of every 100 heat units produced by combustion in the central boiler furnace, 92 are lost and only 7.6 are available to the consumer? How is it possible to make this pay any other way than by charging the lighting consumer between twice and three times more than the power consumer? You say the electric fire is more efficient than a gas fire. It is true that if an electric fire be placed in a room and no circulation of air allowed, then somewhere about 90 per cent. efficiency may be claimed, but people could not live in such an atmosphere, and if the air is changed, the discharge air would carry away the heat, thus reducing the electric efficiency to not far from that of the gas fire.

Gas can allow a 90 per cent. efficiency to the electric fire and still be about three to four times cheaper.

Under any and all conditions, even if electricity be credited with double the efficiency of gas in application, electricity would need to cost less than two-thirds of a penny to compete with gas.

There is only one way whereby electricity can compete with gas, and that way is: build electricity and gas works as one unit and thus allow waste heat and by-products to be utilised. Waste heat from electricity stations can be and is profitably used by industries and for heating baths, wash-houses, hotels, private houses, and office buildings. The coal efficiency, where the above services are rendered, would be increased by 30 per cent., after which we would be within measurable distance of "smoke prevention."

William Baxter,
Member of Local Electric Committee.

Leith, *April 30th*, 1923.

[With regard to the effect of smoke on the atmosphere, electricity works produce but little smoke, and when they are situated, as they should be, at a reasonable distance from populated centres, the latter do not suffer. There is no doubt that a vast improvement has taken place in many towns due to the use of electricity for power in substitution for small steam-engine installations—but the domestic fire is the worst offender. Gas works also should be outside urban areas, for though they do not emit smoke, they undoubtedly pollute the atmosphere in their vicinity.

We do not agree that electricity cannot compete with gas for cooking on an economic basis. We did not say that thermal unit comparisons were fallacious, but that Mr. Baxter's method of comparison on the basis of thermal units supplied was fallacious. Lighting costs more than power owing to capital charges, not to fuel costs. Electric fires should not be used for heating the air of rooms, but for producing radiant heat at the place where it is needed. With our correspondent's advocacy of economy of fuel we are, of course, entirely in sympathy.—Eds. Elec. Rev.]

The Prospects of Electrical Engineers in Canada.

I have been very interested in the recent articles by Mr. G. R. Archdeacon regarding conditions and prospects for the electrical engineer in Canada. Mr. Archdeacon draws a very rosy picture of life in the Dominion, but, having seen so many previous "rosy outlooks," I am inclined to be sceptical. If the prospects are so bright, surely it is possible to come into actual contact with this demand? After reading article II, being an automobile electrician, I assume there will be a job waiting in every town, but assumption and reality are slightly different, and it is much more encouraging to be assured of a job on landing than going on 'spec. Perhaps Mr. Archdeacon or some of your other readers could advise.

Prospective Emigrant.

April 25th, 1923.

Summer Recreation.—To-morrow (Saturday) the bowling green and tennis courts at the Dalmarnock power station, in connection with the Welfare Movement of the Glasgow Corporation Electricity Department, will be formally opened by Mrs. Dewar, the wife of the convener, while Mrs. McInnes Shaw, the wife of the sub-convener, will inaugurate a second tennis court, which has been added since last year. Presentations will be made to the ladies, and tea served in the "all-electric" canteen at the power station.

WORKS PRODUCTION.

Discussion at Newcastle.

Mr. G. H. Nelson's paper on the above subject (which was abstracted in our issue of January 26th, 1923) was read at the North-Eastern Centre of the Institution of Electrical Engineers on March 26th, Mr. F. G. C. Baldwin presiding.

Mr. A. P. Pyne opened the discussion by questioning whether the author's system would be suitable for a medium-sized works, and said it would certainly not be applicable to a small concern. So many works had evolved some sort of system of production and progressing the work that it would be difficult to get them to adopt a new system. All works should have a complete costing system, so that they knew what they were doing, but, as a matter of fact, very few works had a good costing department. Costing to be effective must be done quickly, for values fluctuated so much that old costing was valueless. The same need existed with regard to the ascertainment of establishment charges; it was not sufficient to have them given in the balance sheet at the end of the year. Regarding the timing of machines, the method of charging on a labour basis was preferable in small general works, where the timing principle was not applicable. The card system was not very suitable in a small place, and was absolutely prohibitive owing to the number of cards that had to be dealt with. In dealing with output, he thought the management did not take sufficient account of the human element. The difference of cost between day and night shift was greater than Mr. Nelson suggested. Works committees were very advantageous. He first met with them in France 25 years ago.

Mr. H. W. Miller thought that the system explained by the author was good where there were standard machines, but when they came to diverse machines there might be difficulty in allocating work. He was especially interested in Mr. Nelson's scheme for an employés' sinking fund as a sort of insurance. By co-operation between departments they did not get the same results as by team work; the latter should be the basis of any system of production.

Mr. C. Turnbull said it seemed to him that the author's proposals were practically Hopkinson's methods applied to works production. A large output was necessary if one wanted to meet establishment charges. He had wished that some of the directors of electricity concerns and councillors who controlled them had been present, for he thought it would have opened their eyes. Those gentlemen seemed to think that an engineer was very much like an engine driver. They would say that if only they could get a commercial man in charge they would do twice the work for half the money. That was the way some persons looked at the matter.

Mr. T. Carter said that Mr. Nelson's system could be applied well enough to large works, but was not suitable for small works. Probably the most important part of the paper was that which raised the question as to unemployment insurance; it was quite clear that if trade unions could be guaranteed against unemployment and its effects, they would give up their idea of restricting output. There were two aspects, *i.e.*, unemployment insurance and the provision of work; the former was obviously economically unsound, and if a system of avoiding it could be devised it would be of great advantage to all.

The Chairman said that the Metropolitan-Vickers Co. should be complimented on its broad-mindedness in allowing such a wealth of detail of the scheme to be published. The speaker emphasised the need for co-operation, and urged that without it little would be accomplished.

Storage Battery Locomotive Competition.—Lieut.-Col. G. R. Lane Fox, M.P., the Secretary for Mines, announces that in order to encourage the production of a safe and efficient type of electrical storage battery locomotive for use underground in coal mines, and with a view to displacing pit ponies in deep and hot mines, Sir Charles Markham, colliery director of Ringwood Hall, Chesterfield, has placed at his disposal the sum of £1,000 to be offered as a prize for the best vehicle. Judges representative of the coal mining industry of Great Britain, the Institutions of Mining and Electrical Engineers and the Mines Department, have been appointed to lay down the conditions under which the competition is to be conducted, and to adjudicate upon the merits of competing designs. The competition will be open to manufacturers of any nationality, and the competition will remain open for an adequate period to allow competitors in foreign countries and the Dominions to submit their designs. Working trials in England will subsequently be arranged of those vehicles selected for test. A formal announcement will shortly be made of the conditions.

Gennevilliers Turbo-alternators.—Referring to the article which we published in our last two issues, relating to the 40,000-kW turbo-alternators of the Société Alsacienne de Constructions Mécaniques, of Belfort, for the particulars given we are indebted to Mr. E. Roth, chief engineer of the company, who was responsible for the designs and investigations involved in the construction of these machines.

BUSINESS NOTES.

Bankruptcy Proceedings.—T. S. Cartwright (T. S. Cartwright & Co.), electrical contractor, 90, Wellington Street, Stockport.—First meeting held April 18th, at the Official Receiver's offices, Manchester. Public examination, May 8th, at the Court House, Stockport.

H. South, electrical engineer, late of 10-12, Garrick Street, Covent Garden, W.C.—Order for discharge made on February 13th.

W. E. Weeks, wholesale electrical dealer, 59, Victoria Street, and 12, Filton Avenue, Horfield, Bristol. Trustee, Mr. J. P. Emett, 18, Nicholas Street, Bristol, appointed April 4th. The public examination was held on April 27th, at the Guildhall, Bristol. According to the statement of affairs, the liabilities amounted to £1,693, and there was a deficiency of £715. Debtor attributed his failure to the slump in trade, bad debts and want of capital. The examination was adjourned.

F. Carney, journeyman electrician, 36, Prince Street, Dudley Hill, Bradford.—Receiving order made April 23rd on debtor's own petition. First meeting, May 4th, at the Official Receiver's office, Bradford. Public examination, June 6th, at the County Court, Bradford.

P. Rukin, electrical engineer, Manchester Road Station, Bradford.—Receiving order made April 23rd on debtor's own petition. First meeting May 8th, at the Official Receiver's office, 12, Duke Street, Bradford. Public examination June 6th, at the Court House, Bradford.

F. A. Pilbrow (H. & J. West), electrical engineer, 7b, Stoke Road, Gosport.—Receiving order made April 20th on debtor's own petition. First meeting, May 9th. Public examination, May 14th, both at the Court House, Portsmouth.

J. H. Rigby, electrician, 22, Higher Hillgate, Stockport.—First and final dividend of 6½d. in the £, payable May 7th at the Official Receiver's office, Byrom Street, Manchester.

A. J. Barlow (Barlow Bros), electrical and general engineer, 9, Brunswick Place, City Road, E.C.—Receiving order made April 26th, on debtor's own petition. First meeting May 15th; public examination July 25th; both at Carey Street, W.C.

F. J. Gill, electrical engineer, 26, Hardwick Street, Buxton.—Last day for proofs for dividend, May 16th. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Company Liquidations. — The Associated Electric Traders, Ltd., 2, Percy Street, Tottenham Court Road, W.—The report of Mr. G. D. Pepys, Official Receiver and Liquidator, upon the affairs and failure of this company has been issued to the creditors and shareholders. The winding-up order was made last October upon a creditor's petition, and accounts were filed showing unsecured creditors, £5,719; loan on debenture bond, £2,500; assets valued at £4,042; a deficiency of £4,176 in assets to meet liabilities, and a total deficiency of £9,653 as regarded contributories, the issued capital amounting to £5,477.

Mr. Pepys reports that the company was promoted by Mr. Leonard Courtney Russell and was registered as a private company on September 7th, 1920, with a nominal capital of £10,000 divided into 3,000 10 per cent. cumulative preference shares and 7,000 ordinary shares of £1 each. It was formed to acquire the business carried on at 2, Percy Street, London, W., under the name of the British Electric Trading Co., and to carry on business as wholesale and retail importers, exporters, dealers, &c., of alabaster bowls, marble figures, electrical fittings, &c. Mr. Russell was appointed governing director at a fee of £1,000 per annum, with authority to exercise all powers and authorities vested in the directors generally. The remuneration of the other directors was £100 per annum, and the qualification was the holding of shares of the company of the nominal value of at least £25. All the directors appear to have held the requisite number of shares. Mr. Russell states that for about 18 months prior to the incorporation of the company, the business of the British Electric Trading Co. had been carried on by his stepson, Mr. John Leitch. No formal agreement for the acquisition of the business appears to have been executed, and it is not clear what was the amount of the assets and liabilities acquired or the exact amount of the purchase price payable by the company, nor has it been possible to ascertain how much was actually paid by the company. It is stated, however, that Mr. Russell was to receive 2,000 fully-paid ordinary shares, representing the benefit of a profit of that amount shown by the accounts of the business to July 31st, 1920. The issued capital of the company is 4,827 ordinary and 650 preference shares. Mr. Russell states that, so far as he can ascertain, all the shares were paid for in cash. Mr. Williams (a director) states, however, that he received 2,775 of the ordinary shares, fully paid, as nominee for Mr. Russell, presumably as payment or part payment for the business acquired. According to a trading and profit and loss account prepared for 16 months ended June 30th, 1921, the sales for that period amounted to £28,521. The gross profit is shown at £6,591 and the net profit at £2,071. Dividends on the preference shares were paid in August, 1921, and in May, 1922, amounting to £31 and £23 respectively. The deficiency account in the statement of affairs discloses a large net loss for the whole period of the company's trading. On May 22nd, Mr. C. P. Wenzel was appointed a permanent director, to be accorded the same powers in every respect as Mr. Russell, the governing director, and it was resolved to amend the articles of association accordingly. It was also resolved to increase the capital by the creation of an additional 20,000 ordinary shares, to be allotted, fully paid, as to 10,000 to Mr. Russell in consideration of his transferring to the company his one-half share in a business called the Marylebone Electric Fittings Co., and as to 10,000 shares to Mr. Wenzel in consideration of that gentleman handing over certain foreign agencies and connections. These arrangements, however, do not appear to have been carried out. On the same date (May 22nd, 1922) 25 debentures of £100 each in favour of Mrs. N. Wenzel, secured on the assets and undertaking of the company, are recorded as having been sealed and issued, and a cheque for £2,500 handed to the company. Mr. Wenzel states that the loan was made to enable the business of the company to be extended. The debentures, however, were not delivered to the Registrar of Joint Stock Companies for registration within the statutory time. New debentures appear to have been issued on July 4th, 1922, and registered on July 14th, 1922. On September 20th, 1922, Mr. T. J. Wilson, of 59-60, Old Bailey, E.C., chartered accountant, was appointed by the Court receiver and manager on behalf of the debenture holder, following an interim order made on September 16th, 1922. Steps have been taken at the request of the petitioning creditors to contest the validity of the charge created by the debenture referred to above. The receiver recently reported that he had realised from the assets (valued in the accounts at £4,042) about £1,160, including the proceeds of the sale of the business, and he estimated that the outstanding debts would produce about £800. The failure and insolvency are attributed by Mr. Russell to the depreciation in the values of the stock and to the slump in trade generally.

Thanet Electric Co., Ltd.—A meeting of members is called for May 16th at 840, Salisbury House, London Wall, E.C., to hear an account of the winding-up from the liquidator, Mr. H. Kirby.

Econ Manufacturing Co., Ltd.—By an Order of the High Court, dated April 10th, on the petition of Nettlefold & Sons, Ltd., of 54, High Holborn, W.C., it was ordered that the voluntary winding-up of the company be continued, but subject to the supervision of the Court.

"All-British" Wireless Manufactures Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. Hodgson, 70, Central Buildings, 41, North John Street, Liverpool.

British Generator Co., Ltd.—A meeting of members is called for May 31st at 23, Queen Victoria Street, E.C., to hear an account of the winding-up from the liquidator, Mr. F. J. Carpenter.

Dissolutions of Partnership.—Winch & Holroyd, electricians, 110, Churchill Road, Dollis Hill, N.W.2.—Mr. C. F. Winch and G. W. Holroyd have dissolved partnership. Mr. Winch will attend to debts.

H. L. Wood, Son & Co., electrical engineers, 2, Palmerston Arcade, Grove Road, Southsea, and 36, Russell Street, Portsmouth.—Mr. H. L. Wood and Mr. H. G. Stanton have dissolved partnership. Debts will be attended to by Mr. H. C. Rabbidge, 3 & 4, Clement's Inn, Strand, W.C.

Trade Announcements.—Mr. A. R. Wilson has removed from Swanage, and is opening an office and showroom (as electrical engineer and contractor) at 5a, Chessel Avenue, Boscombe Manor Estate, Bournemouth.

Messrs. John Hunter & Co. have removed to 22, Rodney Street, Liverpool, where they will have electrical showrooms for the display of fittings and domestic appliances and electrical repair worshops. Telephone Nos.: "Royal 3273 and 3274."

Messrs. John Armstrong & Co., electrical engineers and contractors, of Lancaster Buildings, Barton Square, Manchester, are converting their business into a private limited company under the name of John Armstrong & Co. (Manchester), Ltd. There will be no change in the conduct of the business, as Mr. Armstrong, as governing director, will retain full control.

Messrs. Charles H. Smith & Co., factors of electrical supplies and equipment, and British agents for the Industrial Trading Co., Ltd., Copenhagen, of 277/278, Bank Chambers, 329, High Holborn, W.C.1, have removed to 16, Gray's Inn Road, E.C.1, as from May 1st. Telephone: Holborn 5833.

The Surrey Wholesale Electrical Co. has commenced business at Church Path, North End, Croydon, for the supply of electrical accessories and apparatus to the trade, and it asks for manufacturers' catalogues and price particulars.

The Mining Requirements Co., Ltd., Wombwell, near Barnsley, has opened a department for factoring electrical goods for collieries, factories and works, and wishes to receive trade catalogues.

Impag. Ltd., has removed to Leadenhall House, 101, Leadenhall Street, London, E.C. Telephone No.: Avenue 8080.

Mr. R. C. C. Green, representing in the Midland counties Messrs. F. & A. Parkinson, Ltd., Messrs. Holden & Brook, Ltd., and Messrs. Yates & Thom, Ltd., has been joined in partnership by Mr. P. H. Jackson, A.M.I.E.E. (late manager of the Birmingham office of the Electrical Apparatus Co., Ltd.). Mr. John L. Green will continue his connection with them. Their business address will be Grenville Buildings, 12, Cherry Street, Birmingham. They will also represent the Concordia Electric Wire Co., for the Midland Counties, and carry stocks of wires and cables.

Catalogues and Lists.—Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—List O.D.S.I., containing illustrations and particulars of outdoor switchgear of a number of types.

British Pig-Irons, Ltd., Abbey House, Victoria Street, S.W.1.—A booklet containing particulars and illustrations of fractures of various types of pig iron.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—List No. 974, a revised edition of the "Simplex" colliery lighting system booklet.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2.—Pamphlet L. 200/3, dealing with the Marconi "Y" series of portable and semi-portable telephone-telegraph stations; and Pamphlet No. 210, containing an illustrated description of the 500-W portable and semi-portable station.

Radiophones, Ltd., 1a, Granville Place, Marble Arch, W.1.—Folder No. 104, illustrating and describing the "Listoleon" "cabinet de luxe" radio receiving set. Priced.

Electric Fires, Ltd., King Street, Norwich.—An illustrated leaflet dealing with "Heatrae" electric griller-toasters for restaurants, &c.

Engineering Supplies, Ltd., 155a, Upper Thames Street, E.C.4.—A price list of component parts of radio receiving sets.

Messrs. Rogers, Foster & Howell, Ltd., Balsall Heath, Birmingham.—A comprehensive illustrated and priced list of receivers for radio-telegraphy and telephony—crystal and valve.

Messrs. Adam Hilger, Ltd., 75a, Camden Road, N.W.1.—Two illustrated brochures: one describing the "Low-Hilger" audiometer, an instrument for recording the pressure variation caused by sound waves; and the other dealing with Professor Coker's apparatus for determining the distribution of stress in structural and machine members.

The Hotpoint Electric Appliance Co., Ltd., 21, Berners Street, Oxford Street, W.1.—Circular letters announcing reductions in the prices of vacuum cleaners and other domestic appliances. Also a postcard specially printed for the use of municipal electricity departments in connection with their hiring schemes.

Clear-Hooters, Ltd., Highgate Square, Birmingham.—A priced folder illustrating and describing several types of electric motor horns.

Electrical Components, Ltd., 88-90, Great Charles Street, Snow Hill, Birmingham.—Abridged net price list (No. 99) of electrical accessories—bowl fittings, insulators, lampholders, distribution boards, switchgear, &c.

For Sale.—Warrington Corporation Electricity Department invites offers for two 250-kW Willans-Bruce Peebles generating sets. York Corporation Tramways Committee has for disposal three 2-ton Edison-accumulator 24-seater one-man operated omnibuses, also two Lancashire Dynamo Co.'s reducer generator sets, complete with B.T.H. switch panel.

The Great Western Railway Co. Stores Department, Swindon, invites offers for a surplus electrical generating set.

Sale Urban District Council electricity department has for disposal surplus generating plant, &c., owing to changing over its supply.

Southport Corporation Electricity Committee invites offers for surplus electrical plant.

Assets Auction Co., Ltd., will sell by auction, on May 8th and the following day at 119-121, Newington Causeway, radio sets and material. (See our advertisement pages to-day.)

Foreign Exhibitions.—Sweden.—The directors of the International Air Exhibition at Gothenburg have decided to add a section for patents and inventions in connection with air navigation.—*Reuter's Trade Service* (Stockholm).

Poland.—The third annual fair at Posen was opened on April 29th. All the provinces in Poland are represented at the fair, and the number of exhibitors exceeds 2,200. Dantzig firms are also well represented. A good deal of business was done on the first day of the fair.—*Reuter* (Warsaw).

Book Notices.—"Telephony," by T. E. Herbert. Pp. xv+868; 618 figs. Price 18s. net. "Traction Motor Control (Direct Current)," by A. T. Dover. Pp. x+114; figs. 40. Price 2s. 6d. net. London: Sir Isaac Pitman & Sons, Ltd.

"Year Book of Wireless Telegraphy and Telephony, 1923." Pp. xcv+1,745. London: The Wireless Press, Ltd. Price 15s. net.

The preface refers to the commencement of broadcasting in this country, and to the erection of high-power stations in all parts of the world, and states that to keep pace with these developments the work has been completely re-modelled. The existing features have been retained, but their scope has been so enlarged that this volume constitutes an almost entirely new production. A Map Section is included; this shows at a glance the position of every known land radio station in the world. A new section is that devoted to radio direction finding, which includes a *résumé* of progress in this field and the laws governing its use in various parts of the world. Mr. J. St. Vincent Pletts contributes an historical survey of the development of radio telegraphy and telephony. The directory of the radio stations of the world, both commercial and experimental, has been re-compiled, and forms a section of great interest to all engaged in the art.

Office Equipment. Vol. I, No. 1. April. London: The Proprietors, 49, Bedford Street, W.C.2. Price 9d.—This is the first number of a monthly journal described as "the business man's office companion." All manner of time- and labour-saving devices are dealt with—duplicators, calculating machines, typewriters, &c. There is a special section dealing with the furnishing and decorating of offices, and another upon welfare work.

"Alternating Current Electrical Engineering," by W. T. Maccall. Pp. viii+493. Illustrated. London: University Tutorial Press, Ltd. Price 15s.

"How to Build Amateur Valve Stations," by P. R. Coursey. Pp. 70, figs. 70. Price 1s. 6d. net. "The Radio Experimenter's Handbook," Part II, Data and Design, by P. R. Coursey; pp. vi+72, figs. 63, price 3s. 6d.; "Electrons, Electric Waves and Wireless Telephony," by J. A. Fleming, F.R.S., pp. viii+326, figs. 112, price 7s. 6d. London: Wireless Press, Ltd.

"Four Lectures on Relativity and Space," by C. P. Steinmetz. Pp. x+126; 33 figs. London: McGraw Hill Publishing Co., Ltd. Price 10s. net.

"Dictionary of Applied Physics," by Sir Richard Glazebrook, F.R.S., Vol. IV; "Light, Sound, Radiology, pp. viii+914, illustrated. London: Macmillan & Co., Ltd. Price 63s. net.

"Tables Annuelles de Constantes et Données Numériques de Chimie, de Physique, et de Technologie." Paris: Gauthier-Villars et Cie. Paper cover, 11s.; boards, 13s.

"*Journal* of the Institution of Electrical Engineers." Vol. LXI. No. 317. April, 1923. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—This issue contains the following papers:—"The Maintenance of Voltage on a D.C. Distribution System by means of a Fully Automatic Sub-station," by Mr. P. J. Robinson; "Some Problems in High-speed Alternators and their Solution," by Mr. J. Rosen; "The Use of Single-core Sheathed Cables for Alternating Currents," by Prof. W. Cramp and Mr. N. I. Calderwood; "The Measurement of the Electric Intensity of Received Radio Signals," by Mr. J. Hollingworth.

"Science Abstracts" (A and B). Vol. XXVI. No. 304. Part 4. London: E. & F. N. Spon, Ltd. Price 3s. each.

British Trade-Mark Applications. — The following are included among the recent applications for British trade marks. Objections may be lodged within one month from the dates mentioned. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Atmosan. No. 432,760. Class 6. Electrical ozone producing machines. Sir Richard A. S. Paget, Bart., East India House, 74, Strand, London, W.C. April 25th, 1923.

Celestevox. No. 431,000. All goods in Class 8. W. Ivy Rogers, 2, Park Hill, Moseley, Birmingham, J. T. Foster and E. Howell. April 25th, 1923.

Gimbolder. No. 434,798. Class 8. Wireless telegraphy and telephone instruments and apparatus, and parts thereof. Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C. April 25th, 1923.

El Toro (lettering and design). No. 435,049. Class 8. Rubber insulated electric cables. Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. April 25th, 1923.

El Gaucho (lettering and design). No. 435,050. Class 8. Rubber insulated electric cables. Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. April 25th, 1923.

T. C. Hodgkinson. No. 434,055. Class 11. Electric instruments, apparatus and contrivances for surgical or curative purposes, not medical. Thomas C. Hodgkinson, 38, Westcroft Square, Hammersmith, London, W. April 25th, 1923.

Ballsok. No. 434,878. Class 16. Electric insulators. Lionel Robinson & Co., 3, Staple Inn, Holborn, London, E.C. April 25th, 1923.

Resiston. No. 434,701. Class 40. Electric insulating material of hard rubber, and vulcanite articles. The American Hard Rubber Co., 11, Mercer Street, New York, U.S.A. (Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.). April 25th, 1923.

Anglo-French Co-operation.—*L'Electricien* says that the Grammont group has secured for itself important new technical co-operation by an arrangement with a leading English electrical concern. One member of the group, the Société des Ateliers de Construction Electrique de Lyon-Dauphiné, at its meeting on March 13th, ratified the preliminaries for the absorption of the Société Regina, which is itself an offshoot of the General Electric Co. of London. The new board of the Lyon-Dauphiné will now include an ex-high official of the English Posts and Telegraphs Administration, who is also a director of one of the most important English electrical undertakings.

New Plant at Birmingham Technical School.—In connection with the work of installing the new generating sets at the Birmingham Municipal Technical School, tenders were invited for the purchase and removal of the present plant, consisting of four gas engines (three of 30 h.p. and one of 12 h.p.) and two dynamos (each generating 360 A at 110 V). The best tender received was that of the Midland Iron and Hardware Co. (Cradley Heath), Ltd., offering a sum of £105 for the old plant, and this tender has been accepted.

A Long-Service Association.—A new Association has been formed at the Metropolitan-Vickers Electrical Co.'s works at Trafford Park, the members of which can all show 20 years' service or more. It is worthy of note that there are already 302 members of this Association, the majority of whom, including ten women, are workpeople. On Monday last the Association held its first dinner and social evening at the works. The two toasts of the evening were the "Metropolitan-Vickers Electrical Co., Ltd.," and the "Metropolitan-Vickers Long-Service Association." The first of these was responded to by the managing director, Captain R. S. Hilton, who took the chair, and the second by Mr. S. Ratcliffe, J.P., one of the oldest employés of the company, and chairman of the Works Committee. A humorous entertainment was provided by Mr. H. Ward.

The St. Helens Cable Co.'s New Works.—The St. Helens Cable and Rubber Co., Ltd., is shortly to leave Warrington for Slough, and is now engaged in putting down in the new works in the latter town some new machinery, which has been bought to enable it to start up in its new premises with the minimum of interruption to manufacturing operations. When the new plant is in full swing, it is intended to remove the existing machinery from Warrington. The site at Slough, including a factory already erected, is about 200,000 sq. ft. in area. This is considerably more than the present works area, which has been too small for some time past to enable the company's business to be dealt with as promptly as desired. Efforts were made to obtain a suitable factory in the neighbourhood of Warrington, but nothing of a suitable nature nearer than Slough was found. The new factory was built for mechanical transport repairs at the end of the war, and has been practically unused so far. It has excellent facilities with regard to railway lines running through the works on both sides under cover, enabling the various manufactures to be taken right through from the raw materials to finished goods in a series of straight lines, which will considerably add to efficiency compared with the present works operations. It is expected that the majority of the works and staff will follow the company, which is making special arrangements with regard to housing and allowances to old employés. Although a good deal depends upon the delivery of the new machinery, it is expected that the whole of the works will be transferred within the next two or three months.

The E.D.A. "Slogan" Competition.—The British Electrical Development Association states that its "slogan" competition, mentioned in a recent issue, is attracting considerable attention. It is pointed out that applications for the conditions of the competition should not be marked "Slogan," as envelopes so marked are presumed to contain suggestions, and will not be opened until the closing date of the competition.

Unemployment.—The number of persons on April 23rd recorded on the live registers of the employment exchanges in Great Britain as wholly unemployed was 1,234,900. This was 4,625 less than in the preceding week and 250,978 less than the figure recorded on January 1st, 1923. The total included 944,000 men, 44,200 boys, 208,200 women, and 38,500 girls.—*The Times.*

German Imports in Australia.—The chairman of the Commonwealth Tariff Board, Major Oakley, when questioned recently in Adelaide, declared that the Industries Preservation Act had undoubtedly restricted the importation of German and Austrian goods into the Commonwealth. Major Oakley said that the depreciation of the currency enabled the German trader to land goods in the Commonwealth at a figure that no Australian manufacturer could hope to compete against, and the result was that several shipments had been detained pending inquiries. In one instance certain German mechanical toys, which were invoiced at a penny each, could not be produced and sold in Great Britain at 1s. each. The chairman assured Adelaide commercial circles that no German goods of any moment had entered Australia since the removal of the embargo on such importations.—*Reuter's Trade Service* (Melbourne).

Boiler Makers' Lock-out.—On Monday last the lock-out of boiler makers from the shipbuilding yards commenced. The employers' decision was taken as the result of the resolution of men already on strike to continue their protest against the national agreement arrived at between the Federation of Engineering and Shipbuilding Trades and the employers to which the boiler makers refused to subscribe. This agreement provides for overtime and night shift working under certain conditions, and abolishes the "datal" system of payment.

Australian Tariff Decisions. — The following tariff decisions have been approved by the Customs Department:—Machines, machinery, &c. (metal working), broaching machines (textile working, &c.), cutting machines, Diesel engines, and flanging machines, all under item 174, free under the British preferential tariff, 5 per cent. under the intermediate tariff, and 10 per cent. under the general tariff.—*Reuter's Trade Service* (Melbourne).

A Swedish Manufacturing Company.—It is announced from Stockholm that the A.B. Elektraverken reports a loss of 670,000 kronen for 1922, as compared with a loss of 1,980,000 kronen in 1921. The deficiency is to be carried forward, as was also the case in the previous year.

Swedish Home and Export Trade.—Mr. B. Traneus, discussing some questions of interest to the industry at the annual conference of the Swedish Association of Electrical Industry, held in Stockholm, on April 25th, is reported to have stated that as a result of the development in the past forty years, a relatively rapid saturation of electrical requirements must be expected in certain branches. But as the consumption of energy per inhabitant was still far below that obtaining in various countries, it would be possible to reckon on a large demand for electrical machinery in Sweden in the distant future. The high quality of Swedish electrical plant had rendered it possible in the past thirty years for the electrical firms to work up and maintain an export trade amounting to 30 per cent. of the national production, and this fact led to expectations of a further favourable development also of the export market in the future.

Electrical Business in South Africa.—Reporting at the end of last month, the *South African Mining and Engineering Journal* stated that the recent spurt in the building trade had made itself felt in the electrical goods branch, and trading was on a much sounder basis than it had been during the past few months. Dealers were confident that business would gradually improve.

Australian Foreign Trade.—In forwarding to the Department of Overseas Trade the statement of the foreign trade of Australia during January and the first seven months of the present financial year, Mr. S. W. B. McGregor (H.M. Senior Trade Commissioner in Australia) reviews the statistics briefly. Imports, which totalled £11,602,638, were £1,142,394 greater than those of December, and £2,948,493 above those of January, 1922. Exports for the month (£10,108,950) were a little lower in values as compared with January, 1922, but they were more than £3,000,000 lower than those of December last. The value of the imports for the seven-month period was £24,208,216 above that for the equivalent period of 1921-22, the total being £77,248,406. Increases in this section were general, but one of the principal items was "machines and machinery and iron and steel," which totalled £19,044,636, as against £14,329,729. On the export side the figure for the seven months, £68,138,537, is practically the same as the 1921-22 total, £68,453,091. The value of exported lead rose from £919,690 to £1,499,196, but copper exports fell from £532,879 to £321,683.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

LONDON.—June 1st to 14th, International Mining Exhibition; August 31st to September 22nd, Shipping, Engineering, and Machinery Exhibition; September 8th to 14th, Bakers' Exhibition; October 15th to 20th, Motor-Cycle and Cycle Show; November 22nd to December 1st, Motor Exhibition.

CANADA (*Toronto*).—August 25th to September 8th, Canadian National Exhibition.

ESTHONIA (*Reval*).—June 2nd to 11th, Commercial and Industrial Exhibition.

FINLAND (*Helsingfors*).—July 1st to 7th, International Samples Fair.

FRANCE (*Bordeaux*).—June 15th to 30, Samples Fair.

JAVA (*Bandoeng*).—July 28th to August 12th. Trade Fair.

LATVIA (*Riga*).—July 22nd to August 5th, Industrial and Agricultural Exhibition.

MADAGASCAR (*Antananarivo*).—August 15th to September 15th, International Commercial Fair.

NORWAY (*Christiania*).—September 2nd to 9th. Samples Fair.

SPAIN (*San Sebastian*).—July to September, Samples Fair.

SWEDEN (*Gothenburg*).—August 20th to 26th. Trade Fair.

TRIESTE.—September 3rd to 24th, International Samples Fair.

UNITED STATES (*New York*).—July 23rd to August 3rd. National Merchandise Fair.

URUGUAY (*Montevideo*).—December, Industries Exhibition.

New French Companies.—Pinson et Cie. is the style of a company formed to manufacture electrical lighting apparatus for motors and other accessories. Its offices are at 39, Rue Popincourt, Paris, and its capital 140,000 fr.

Buenos Aires Electricity Works.—As is known, the undertaking of the German Transmarine Electricity Co., in Buenos Aires, was transferred two or three years ago to the Sociedad Hispano-Americano de Electricidad of Madrid, and 52 per cent. of the latter's capital is now held by a group composed of Spanish, English, French and Swiss interests. A large participation in the new company is also held by the Belgian Société Financière de Transports et d'Entreprises Industrielles. According to statements made by the chairman of the latter company at the recent annual meeting, the Société Financière stands in a privileged position in relation to the Spanish-American company, as it prepares technical schemes and plans, and is also entrusted with the allocation of the orders for that company. In this respect, the chairman added, Belgian works receive a large portion of the orders.

Local Exhibition.—Braintree.—Among the firms who exhibited at the recent exhibition arranged by the East Anglian Electricity, Ltd., were the Metropolitan-Vickers Electrical Co., Ltd.; the General Electric Co., Ltd.; Electrical Utilities, Ltd.; Electric Appliances, Ltd.; the Singer Sewing Machine Co.; and Messrs. Falk, Stadelmann & Co., Ltd.

A Trade Commissioner at Vancouver.—H.M. Trade Commissioner Service has been strengthened by the transfer of Mr. L. B. Beale, the present Trade Commissioner at Winnipeg to a new Trade Commissioner post established at Vancouver (210, Winch Building), British Columbia. The Winnipeg office will remain under the control of Mr. Beale with a clerk in charge.

LIGHTING AND POWER NOTES.

Australia.—Sydney.—The Electricity Supply Committee of the Sydney City Council has recommended a reduction in the charges for electricity as from April 1st. The reductions will include ¼d. per kWh for lighting, .3d. per kWh for power for manufacturing purposes, and 20 per cent. reduction in the charge for the hire of electric motors. On July 1st next, it is proposed to bring into effect a 10 per cent. cut in the charges for public street lighting throughout the metropolitan area.—*Reuter's Trade Service* (Melbourne).

Billingham.—Electricity Supply.—The Urban Council has received a communication from the Electricity Commissioners relative to an application by the Cleveland & Durham County Electric Power Co., for a Special Order to supply electricity within the Council's area. The Commissioners intimate that they are prepared to give favourable consideration to the application, and inquire if the Urban Council has any objections to offer. The Council has referred the matter to the General Purposes Committee.

Blackpool.—Year's Working.—During the last municipal year, the Corporation Electricity Department has connected 1,258 consumers. The surplus was £24,000, as compared with £14,322. New plant, with a capacity of 10,000 kW, is in course of erection, together with a new switch-room annexe. The first new 5,000-kW generator which is now being installed is expected to be in service by July. It is anticipated that the second set will be completed in time for the winter load.

Canada.—Two Large Contracts.—According to the *Electrical News* (Toronto) a contract has been placed by the St. Maurice Power Co., Ltd., with the Canadian Westinghouse Co., Ltd., for four vertical-type, water-wheel-driven generators, 33,000 kVA, 60 cycle, 6,600 V, 120 r.p.m. The order includes twelve 11,000-kVA, single-phase, 60-cycle, oil-insulated, water-cooled transformers, 6,600 to 114,000 V; two 1,500-kVA, 3-phase transformers, 110,000 to 550 V; twelve 600-A., 110,000-V, three-pole, oil circuit breakers, solenoid operated, and three 600-A., 110,000-V oil circuit breakers, solenoid operated.

Another contract has been placed with the Canadian Westinghouse Co. by the Quebec Development Co. for eight 30,000-kVA, 3-phase, 60-cycle, 112½ r.p.m., 13,200-V vertical-type generators for the latter company's power station on the Saguenay River, a few miles from Lake St. John.

Continental. — France. — The Société Civile, Normande d'Etudes has just applied for a concession to develop two waterfalls on the River Orne, for supplying electricity to 15 communes in the Department of the Orne. The output of the two stations projected is estimated at 21,000,000 kWh yearly. The cost of the scheme is estimated at 28,000,000 fr.

There has been formed at Lons-le-Saulnier the Société des Forges de Blye, with a capital of 3,000,000 fr., for the generation and distribution of electricity.

Russia.—A Moscow journal says that the Tiflis Committee has decided to place orders with the Petrograd Engineering Constructional and Electric Machinery Constructional Trusts for the equipment of the hydro-electric station to the extent of about a million gold roubles value—on the River Kura, 18 versts from Tiflis. The engineering trust, however, is ordering water turbines abroad in order to expedite the work.

It has been decided to construct and equip a power station at Kargopol. Work is proceeding energetically with the restoration of the old power station at Ust Medveditrky, Tzaritzin.

Glasgow.—"All-electric" Flats.—Owing to the housing shortage large houses are being converted into separate flats, and the upper flats, which have no provision for heating or cooking, are being made "all-electric." The Corporation electricity department, with the consent of the proprietors, the Cambridge Property Trust, Ltd., is giving an exhibition in one of the converted houses to demonstrate what can be done to meet all ordinary requirements electrically.

Gourock.—Electricity Supply.—In connection with the Gourock Electricity Order, in which authority is sought to obtain a supply of electricity from Greenock, the Town Council has come to an agreement with the Greenock Corporation on the question of a minimum charge, and the Corporation has withdrawn its opposition to the Order.

Guildford.—Electricity Profits.—The Corporation electricity undertaking shows a profit of £18,260 in 18 months, and £4,300 has been allocated to the relief of the rates.

Halifax.—Loans.—Application is being made to the Electricity Commissioners for sanction to borrow £30,000 for mains, and £13,000 for transformers and switchgear.

Houghton-le-Spring (Co. Durham).—Electricity Supply.—The Urban District Council has decided to ascertain from the electric lighting company the cost of lighting the district by electricity.

Ilford.—Proposed Linking Up.—The Urban Council has instructed the electrical engineer to prepare and submit a scheme for linking up with the West Ham Corporation undertaking.

India.—Punjab Hydro-electric Development.—Replying to a question in the Punjab Legislative Council regarding hydro-electric schemes in the Punjab, the Hon. Lala Harkishen Lal said that certain tentative offers had been made to the Government by English financiers in connection with concessions for the hydro-electric schemes now under investigation in the province. The Government was giving most serious consideration to the best way of financing hydro-electric schemes, and investigations were in progress. It was not yet possible to say what method would finally commend itself to the Government but, generally speaking, it was considered that provincial ownership of hydro-electric undertakings would prove more profitable to the province, and more expeditious as a whole than private enterprise.—*Reuter's Trade Service* (Bombay).

Kingston-on-Thames. — Loan Sanctioned. — The Town Council has received sanction from the Electricity Commissioners to a loan of £9,624 in respect of a turbo-alternator and auxiliary plant, for the electricity works.

Northern Ireland.—Lurgan (Co. Armagh).—The Urban Council has decided to abandon the electric lighting scheme, on the ground that the cost of interest on a loan for work already undertaken in connection with it would involve 4d. in the £1 on the rates. The total estimated cost of the project was £20,000.

London.—City Electricity Charges.—At last week's meeting of the City Corporation, a motion was passed instructing the Streets Committee to consider and report upon the charges for electricity in the City made by the two supply companies concerned. It was pointed out by the proposer that for some years one company only supplied electricity within the area, and its charges were not more than 4½d. per kWh. To stimulate competition in the hope of reduced prices, the Corporation allowed a second company to lay mains. The result expected was not obtained, and at the present time the charge was 8d. per kWh. The last dividends of the two companies had shown a large increase over those of 1913. It was considered that the high rates of charge were unjustified.

Maidstone.—Reduction of Hire Charges.—The Council has decided to reduce the charges for the hire of electrical apparatus, as from April 1st.

Mexico.—Hydro-electric Development.—The Government of the State of Chihuahua has granted a concession to the Compañia Agricola y de Fuerza Eléctrica del Rio Conchos (S.A.), to extend its transmission lines from its present hydro-electric plant, situated at Boquilla (near Ciudád Camargo) in the State of Chihuahua. The contract calls for the supply of power to the near-by smelters and adjacent mining camps. The concession extends to the year 1941. The h.p. transmission lines to be constructed will each be approximately 90 miles in length, the entire work, including towers, relay-stations, transformers, &c., costing approximately £140,000.—*Reuter's Trade Service* (Mexico City).

Morecambe.—Special Order.—The Corporation is applying to the Electricity Commissioners for a Special Order, authorising it to extend its area of supply, so as to include the urban district of Heysham, part of the parish of Slyne with Hest, and a portion of the township of Heaton with Oxcliffe; also to increase the maximum charge for electricity supply.

Norwich.—Correction.—We regret that in the note under this heading, which appeared in our issue of April 27th, an application for authority to charge 10d. per kWh for electricity was attributed to the Norwich Corporation. This was incorrect; the application was made by the Lowestoft Town Council.

North Africa.—Morocco.—Under French auspices, companies have recently been formed in Marrakech, Saffi, and Mazagran to erect central power stations in these three towns, work in connection with which is already proceeding.

Nuneaton.—Extension of Supply.—The Corporation has decided to extend its area of supply so as to include Ansley, Hartshill, and Chapel End. The estimated cost of laying the mains is £8,000.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

Dover.—Lighting, 8d. per kWh; power, 3d. per kWh; heating and cooking, 1½d. per kWh.

Tyldesley.—Lighting, from 7d. to 6d. per kWh. Minimum charge per quarter from 10s. 6d. to 7s. 6d.

Retford.—Electricity Supply.—At a recent meeting of the Town Council proposals were put forward for an electricity supply for the town. It was pointed out that the district was included in the North-East Midland Electricity District, but that eight or ten years might elapse before it would be possible to obtain a supply, and that independent action should be taken in the meantime. The Town Council has been advised by its consulting engineers to apply to the Electricity Commissioners for authority to generate and supply electricity. The estimated cost of the scheme is £25,000, and the estimated income for the first two years £10,500.

TRAMWAY AND RAILWAY NOTES.

Australia.—Victoria.—The electrification of the suburban railways has now been completed, and the Victorian Railway Commissioners are considering the electrification of country lines.—*Reuter* (Melbourne).

Canada.—New Electric Railway.—An electric railway is shortly to be constructed from Duluth to the International bridge, and probably extended to Fort William. Power will be provided by utilising the falls on the Pigeon River, involving an arrangement between the Canadian and United States Governments, as the river is an international stream. —*Reuter's Trade Service* (Fort William).

Continental.—France.—Dealing with the question of electric traction, the report of the Compagnie des Chemins de Fer du Midi states that the first power station (the Hourat) will be brought into operation in the present year. The 150,000-V transmission lines are almost completed, and it will be possible to transmit energy from the Pyrenées to Bordeaux and Toulouse by October next. Electric locomotives are already in service on the section from Pau to Tarbes, and electric traction will be introduced on the remainder of the line from Toulouse to Dax in the second half of 1923. At present the rolling stock consists of three electric locomotives, 43 passenger motor coaches, and 10 goods motor wagons.

Japan.—Railway Electrification.—The Toho Electric Power Co. is to establish a subsidiary company to carry out the work of constructing the Sangu electric railway. Power will be obtained from a hydro-electric power station in the Yokkaichi district. Application is being made to the Government for sanction to carry out the work.

Leeds.—Light Railways.—The Ministry of Transport has made the Leeds Corporation Light Railways Order, 1923, authorising the construction of light railways in the town and in the rural district of Hunslet.

Liverpool.—New Routes.—The Tramways Committee has submitted to the City Council a recommendation for five tramway extensions involving a capital expenditure of £168,000.

New Tramway Depot.—According to the *Electric Railway and Tramway Journal*, prior to formulating a scheme for the utilisation of the Edge Lane Hall estate as a tramway depôt for storage and repairs, at a cost of £300,000, the Tramways Committee has sent a deputation to London, Birmingham, Glasgow, Leeds, and York. From the observations in these cities, a depôt is to be planned to deal with the overhauling, with the aid of electric cranes, of over a dozen cars weekly, or the whole of the fleet of 650 cars in a year.

London.—The automatic signalling system between Highgate and Tufnell Park on the Hampstead and Highgate tube went out of action shortly before 8 a.m. on April 30th. Signals actuated by hand were put into operation, but considerable congestion was caused at the stations. Normal conditions were restored by 10 a.m.

An Historic Locomotive.—The first electric locomotive operated on the first tube railway in the world has made its last journey. "No. 1" was designed and constructed by Messrs. Mather & Platt, and commenced to run in daily service upon the City & South London Railway in 1890. Its last journey was from its "natural surroundings" at the Stockwell depot, to the Science Museum at South Kensington.

Newcastle-on-Tyne.—New Cars.—The City Council proposes to purchase 25 new tramcars at a cost of £50,000, and application is to be made to the Ministry of Transport for sanction to the borrowing of this amount.

Oldham.—Year's Working.—The net surplus on the tramway undertaking for the past year was £18,595, as compared with £16,722 in the previous year.

Sunderland.—Proposed Linking-up.—The Sunderland and South Shields Tramways Committees held a conference last week to consider a proposal to link up the tramway undertakings of the two Corporations. The scheme is strongly favoured at South Shields, but as yet no great interest has been displayed towards it in Sunderland. The distance between the two systems is about four miles, and the suggestion is that the lines should meet midway at Cleadon. The Sunderland Tramway Committee agreed to go over the ground of the proposed extension.

TELEGRAPH & TELEPHONE NOTES.

Belgium.—Telegraphists' Strike.—A dispute among the postal, telegraph, and telephone workers regarding wages, which has been threatening for some time, has now assumed a more critical phase; 150 linemen are already on strike at Antwerp, and according to the newspapers 120 telegraph and telephone workers are also out at Liége and another 100 are on strike at Verviers.

Canada.—Bell Telephone Extensions.—The Bell Telephone Co. of Canada announces a programme of extensions and improvements involving an outlay of $13,000,000. About eight millions will be spent in Toronto and Montreal for new exchange buildings and apparatus.—*Reuter's Trade Service* (Montreal).

France.—Telephone Charges Raised.—The charges for telephone messages from France to Great Britain, Holland, Germany, Italy, and Spain were trebled on May 1st in accordance with the law passed on February 28th extending to international telephone communication the measure actually in force for foreign telegrams, by which the charge is multiplied by a coefficient according to the rate of exchange.—*The Times.*

Italy.—Transfer of State Telephones to Private Enterprise.—The Commercial Secretary at Rome has forwarded to the Department of Overseas Trade a copy and translation of the Royal Decree No. 399, dated February 8th, which empowers the Government to transfer the telephone service to private enterprise, and prescribes the general conditions under which this can be done. A copy of the Decree can be inspected by British firms interested on application to the Department of Overseas Trade (Room 52), 35, Old Queen Street, Westminster, London, S.W.1.

The Telephone Service.—Weather Reports.—The Post Office, in conjunction with the Air Ministry, has made arrangements, which came into operation on May 1st, to communicate daily weather reports to the telephone exchanges throughout the country. For this purpose England, Scotland and Wales have been divided into some 40 districts, so that each exchange may have available for subscribers information that will be appropriate to the area in which the exchange is situate. It will only be necessary for telephone subscribers to ring up the operator at the local exchange at or after 5 p.m. to obtain the forecast for the following day. No charge will be made beyond the local call fee (1½d.) and in the case of rural party-line subscribers no fee is payable. The forecast may be obtained also by ringing up from public call offices upon payment of the ordinary local call-office fee.

United States.—New Telegraphic Code.—The invention of a new method of sending telegraphic signals, which is calculated to increase the speed of transmission by 150 per cent., was announced on April 24th to the National Acadamy of Sciences at its annual meeting at Washington by Major-General Squier, Chief of the United States Signal Service. It is proposed to displace the present Morse and cable alphabets by an alphabet where the signal units shall all occupy equal lengths of time and have an equal importance whether they be dots, dashes or spaces. These are to be differentiated by different intensities of a sinusoidal wave exactly in the manner that music and speech are formed.—*The Times.*

RADIO-TELEGRAPHY AND TELEPHONY.

Broadcasting.—New Studio Opened.—Another step was taken on May 1st towards the improvement of broadcasting, when a new studio was opened at the premises of the British Broadcasting Co. at Savoy Hill. The underlying principle in equipping it has been to eliminate echo within and sound from without. All the walls have been lined with six layers of sacking, weighing about five tons and representing some five miles of material, and the floor is covered with heavy felt and carpets. The microphone used is a great improvement upon those employed hitherto. It will receive the voice or instruments in any part of the studio, thus making it unnecessary to speak, sing, or play very near to it. Naturally, in a room so constituted there are difficulties of ventilation.

A privileged body viewed the studio on the occasion of its opening; and Lord Gainford, chairman of the company, took the opportunity of addressing the thousands of listeners-in throughout the country.

Broadcasting Committee.—According to the *Daily Telegraph*, the first meeting of the Committee that was appointed to consider the agreement between the Post Office and the British Broadcasting Co., and the future of broadcasting, was held on May 1st at the General Post Office. Major-General Sir Frederick Sykes presided, and the Postmaster-General (Sir William Joynson-Hicks) attended formally.

Procedure was discussed, and it was arranged to meet again next day, when evidence in explanation of the present position was to be given by representatives of the Post Office. The committee is communicating with the various interests concerned, and evidence will be taken on the subject of the inquiry from all points of view. It is proposed that the committee shall in future hold two meetings a week. The proceedings will be private.

The conference between representatives of the B.B.C. and of the theatres to discuss the broadcasting of plays, &c., was held on May 1st and 2nd, and the negotiations were in progress when we went to press.

A meeting of delegates in connection with theatrical, music-hall, and concert entertainments, on April 27th, decided that the broadcasting of plays and similar entertainments should be stopped, on the ground that it was prejudicial to the interests of all connected with places of public entertainment. Four sub-committees were set up to consider what measures should be taken to stop the broadcasting of plays and prevent artists and actors taking part in it.

Broadcasting is looked upon as State-aided entertainment in competition with other forms of entertainment from which the State derives considerable revenue. The Postmaster-General has been asked to add a theatrical representative to the Committee which he has appointed to "consider broadcasting in all its aspects."

Unauthorised Possession of Radio Apparatus.—At Belfast, on April 26th, John William Milan, an electrician, was summoned for being in unauthorised possession of an apparatus capable of sending or tapping wireless messages. The case was adjourned for a week without being gone into.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—BUENOS AIRES.—June 4th. Department of Navigation and Ports. Machine tools, electric motors, pumps, electric battery trucks, ceiling, wall, and table fans.*

Ashton-under-Lyne.—May 14th. Town Council. Electric light installation, town yard buildings and hospital. Borough electrical engineer.

Atherton.—Electrical organ-blowing equipment, complete with switchgear, for Atherton Baptist Church. Mr. W. F. Benson, Brookland House, Leigh Road, Leigh.

Australia.—MELBOURNE.—August 31st. Victorian Electricity Commission. 500 miles of .0707 sq. in. aluminium steel-cored cable.

July 31st. Electricity Commissioners. Electrically-operated power shovel. (April 20th.)

June 12th. Postmaster-General's Department. Power plant.*

June 5th. City Council. 6,600-V switchgear for sub-stations.

BRISBANE.—June 5th. Public Works Department. Three motor-driven pumps.

October 31st. City Electric Light Co. One 12,500-kW turbo-alternator unit at Bulima, Brisbane.—*Reuter's Trade Service* (Melbourne).

SYDNEY.—June 21st. Postmaster-General's Department. Telephone switchboard wire and switchboard and multiple twin underground cable.*

May 17th. Telephone switchboard parts.*

June 11th. City Council. 10,000-V earthing reactance and resistances.

Belfast.—May 7th. Electricity Department. One 1,000-kW and one 1,500-kW rotary converters, with transformers, switchgear, &c. (April 20th.)

May 22nd. Switchgear for sub-station and transformers. (See this issue.)

Belgium.—The municipal authorities of Brussels have this week invited tenders for the supply of 37,870 metres of three-phase cable and 21,600 metres of telephone cable.

May 11th. Municipal authorities of Rothem (Canton of Maeseyck). For the establishment of electricity distribution systems in the villages of Stockheim, Dilsen, Rothem, Eelen, and Lanklaer.

May 25th. Municipal authorities of Beaufays (Province of Liége). Electrically-operated pump in connection with the local water supply.

Bradford.—June 7th. Electricity Department. One 15,000/20,000-kW turbo-generator, &c. (without condensing plant). (April 27th.)

Darlington.—May 18th. Electricity Department. Cooling tower. (See this issue.)

Dover.—May 17th. Electricity Department. One turbo-alternator with auxiliaries, cables, switchgear, converting plant, cooling pond, &c. (See this issue.)

Dundee.—May 18th. Electricity Department. L.p. twin paper-insulated lead-covered armoured cable. (See this issue.)

Edinburgh.—May 15th. Electricity Supply Department. Underground insulated cables for 12 months. (April 27th.)

Glasgow.—May 8th. Tramways Department. Supply of materials, including brake blocks, castings, rubber and absestos goods, wire springs, &c. Tramway Manager.

Ilford.—May 8th. Electricity Works. 500-kW converting plant. (April 20th.)

India.—ALLAHABAD.—July 3rd. Public Health Department. Pumping plant, consisting of oil engines, generators and motors and centrifugal pumps at Fyzabad in connection with the water supply scheme. Executive engineer of the Second Division of the Public Health Department, Allahabad.—*Reuter's Trade Service* (Calcutta).

London.—PADDINGTON.—May 14th. G.W. Railway Co. Stores for 6 months, including telegraph instruments, electrical apparatus, wires and cables, &c. (April 27th.)

INDIA STORE DEPOT.—May 18th. Electric cables. (See this issue.)

ST. PANCRAS.—May 17th. Electricity Department. E.h.p. switchgear. (See this issue.)

May 23rd. Metropolitan Asylums Board. Installation of electric lighting in the administrative block, engineers office block and isolation ward block at the North-Western Fever Hospital, Lawn Road, Hampstead, N.W. (See this issue.)

Manchester.—May 8th. Tramways Committee. Three one-man operated motor-'buses complete. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

May 29th. Electricity Committee. Twelve months' supply of cable. (See this issue.)

May 10th. Electricity Committee. Three-phase, 6,600-V sub-station switchgear. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall, Manchester.

New Zealand.—WELLINGTON.—June 26th. Public Works Department. Switchgear for the Waikato power house.

NAPIER.—Borough Council. One 500-kVA generator and exciter set. Hay, Vickerman & Lancaster, Ltd., Wellington, N.Z.*

DUNEDIN.—May 28th. City Council. Storage battery and distribution transformers.*

July 16th. Switchboard panels.*

Nottingham.—Corporation. Two 4-ton electric vehicles for the collection of house refuse. (April 27th.)

Plymouth.—May 15th. Electricity Department. Two water-tube boilers, with economisers. (See this issue.)

Poole.—May 28th. Town Council. Electrical installation, waterworks pumping station, Corfe Mullen. Mr. A. P. I. Cotterell, engineer, 17, Old Queen Street, Westminster, London, S.W.1.

Salisbury.—May 17th. Town Council. Wiring and fitting part of the Council house, for electric lighting. City engineer and surveyor.

South Africa.—May 14th. Rand Water Board. 1,800-h.p. pin-type insulators, shackles and cross arms.*

St. Johnston (Co. Donegal).—June 1st. Installation of an electric lighting plant in the church. Rev. D. Watson, St. Johnston.

Uruguay.—MONTEVIDEO.—June 12th. State Electric Light Works. 42,000 metal-filament electric lamps.*

York.—May 10th. Electricity Department. One 1,000-kW motor generator and switchgear. (April 27th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Belfast.—Electricity Committee. Recommended:—

D.c. switchgear for the three sub-stations.—Hurst Electrical Plant, Ltd., Belfast.

Centrifugal pump for harbour power station.—Drysdale & Co., Ltd.

Belgium.—Seventeen firms tendered last week for the contract for the supply of 15 2½-ton electric cranes for the Antwerp docks. The tenders ranged from 1,695,000 fr., submitted by the Société des Ateliers de Construction de la Biesme, of Bcuffioulx, Belgium, to £49,500 (approximately 3,900,000 fr. at current exchange) by the General Electric Co. of Belgium, Ltd., Brussels.

Glasgow.—Tramways Committee. Recommended:—

V.I.R. cable.—Western Electric Co., Ltd.

Steel tires.—Steel Co. of Scotland, Ltd.

Brass tubing.—P. & W. McLellan, Ltd.

Tramways Committee.

5,000 tons of rails (£11 per ton).—Cargo Fleet Co., Ltd. This offer was the lowest.

Electricity Committee. Recommended:—

1,000-kW rotary converter for the Byres Road sub-station (£3,846).—British Thomson-Houston Co., Ltd

Government Contracts.—The following Government contracts were placed during March, 1923:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Cells.—Fuller's United Electric Works, Ltd.
Inert cells.—The Edison Swan Electric Co., Ltd.
Condensers.—Dubilier Condenser (1921), Ltd.
Electric cooking equipment.—General Electric Co., Ltd.
Electrodes.—Quasi-Arc Co., Ltd.
Electric furnace control equipment.—Watford Electric and Manufacturing Co., Ltd.
Porcelain insulators.—Bullers, Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Coil winding machine.—Igranic Electric Co., Ltd.
Motors.—Laurence, Scott & Co., Ltd.
Automatic starter for 1,100-h.p. motor.—Brook Hirst & Co., Ltd.

AIR MINISTRY.

Electrical wire.—General Electric Co., Ltd.
Electric wires and cables.—Enfield Ediswan Cable Works, Ltd.

CROWN AGENTS FOR THE COLONIES.

Static transformers.—English Electric Co., Ltd.
Switchgear.—British Thomson-Houston Co., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Testing protective apparatus, &c.—Phœnix Telephone and Electric Works, Ltd.

Maidstone.—Town Council. Accepted:—
Transformer for supply at the mills of Townsend, Hook & Co. (£210).—Brush Electrical Engineering Co., Ltd.

Manchester.—Baths and Wash-houses Committee.
Electric lighting work at Osborne Street public wash-house.—Messrs. R. H. Clampett & Co. approved as sub-contractors.

Electricity Committee. Accepted:—
Cables.—Macintosh Cable Co., Ltd.; W. T. Glover & Co., Ltd.; British Insulated & Helsby Cables, Ltd.

Tramways Committee. Accepted:—
Portable loader for the Permanent-way Department.—G. Robson & Co.

Salford.—Tramways Committee. Accepted:—
Two single-deck motor-omnibuses (£1,470 each). Two double-deck motor-omnibuses (£1,440 each). Total £5,820.—Leyland Motors, Ltd.

Electricity Committee. Accepted:—
Chain-grate stokers for Frederick Road power station (£2,500); 300 tubes for economisers (£458).—Babcock & Wilcox, Ltd.

Spenborough.—Urban Council. Accepted:—
Cable and trifurcating boxes.—Western Electric Co., Ltd.

West Ham.—Education Committee. The following tenders have been received for electric wiring and fittings at 12 schools. Mr. J. H. Jacques, architect to the Committee:—

List of Tenders for Electrical Installations at West Ham Schools.

	Whitehall Place.	Upton Lane.	Water Lane.	Maryland Point	Bridge Road.	Manor Road.	Balaam Street.	New City Road.	Russell Road.	Beckton Road.	Star Lane.	Hermit Road.
	£	£	£	£	£	£	£	£	£	£	£	£
H I Cash & Co., Ltd.	686	692	802	510	622	808	817	686	846	743	805	860
Chapman & Sturton	—	—	—	—	—	—	—	945	—	—	—	—
Frank Craft (Castleford), Ltd. (Accepted)	**405**	**392**	**552**	**297**	**323**	**497**	**453**	**419**	**482**	**403**	**542**	**488**
A. F. Goodwin & Co.	635	650	855	465	525	754	785	705	755	645	725	755
Hives & Radford	499	477	642	355	422	596	—	547	—	521	571	—
Higgs & Hill, Ltd.	647	707	875	537	574	807	767	721	817	687	797	817
Higginbotham & Sons	569	585	720	435	495	677	653	600	700	578	658	675
Malcolm & Allan, Ltd.	592	579	732	427	473	686	634	606	687	580	681	682
A. F. Marshall	688	689	876	498	598	759	749	658	689	625	678	698
Ryeland & Co.	867	893	1,137	653	726	1,027	973	940	1,005	800	917	1,036
Samuel Reed & Sons	680	656	850	477	562	783	757	723	799	677	775	798
Upton & Garrett	697	689	936	636	646	893	872	672	874	699	863	872
Symper & Evershed	1,185	1,185	1,573	890	1,000	1,405	—	—	—	—	—	—
West Ham Corporation (Elec. Dept.)	817	873	1,101	624	722	981	963	887	1,043	850	973	972
Troup, Curtis & Co., Ltd.	860	860	1,124	639	733	1,000	942	864	1,033	849	951	984

Terminal blocks.—Phœnix Telephone & Electric Works, Ltd.
Leclanché battery boxes.—Siemens Bros. & Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—Connollys (Blackley), Ltd.; Enfield Ediswan Cable Works, Ltd.; General Electric Co., Ltd. (Peel-Conner Telephone Works); Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.
Joint box castings.—J. Varley & Co., Ltd.
Parts for secondary cells.—Hart Accumulator Co., Ltd.
Loading coils—Western Electric Co., Ltd.
Compound.—W. H. Keys, Ltd.
Telephone cords.—Phœnix Telephone and Electric Works, Ltd.
Dessicators and pumps.—Lacy-Hulbert & Co., Ltd.
Ducts.—G. Jennings; Mountford, Phillips & Co. (1920), Ltd.
Insulators.—Taylor, Tunnicliffe & Co., Ltd.
Amp.-hour meters.—Chamberlain & Hookham, Ltd.
Earth plates.—J. Ash & Son, Ltd.
Jointing sleeves.—Dugard Bros., Ltd.; C. M. Powell Bros.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. incorp. in the London Electric Wire Co. & Smiths, Ltd.
Copper wire.—Elliott Metal Co., Ltd.; Shropshire Iron Co., Ltd.
Flameproof wire.—Macintosh Cable Co., Ltd.
Switchboard wire.—General Electric Co., Ltd. (Peel-Conner Telephone Works).
Telephone exchange equipment.—Golders Green: General Electric Co., Ltd.; sub-contractors for batteries, D.P. Battery Co., Ltd.; for charging machines, Crompton & Co., Ltd. Woodford: General Electric Co.; sub-contractors for batteries, Tudor Accumulator Co., Ltd.; for charging machines, Crompton & Co., Ltd. Whitley Bay: British L.M. Ericsson Manufacturing Co., Ltd.; sub-contractors for batteries, Tudor Accumulator Co., Ltd.; for charging machines, Crompton & Co., Ltd.; Woolland Bros., Ltd.; Automatic Telephone Manufacturing Co., Ltd. Manchester Central: General Electric Co., Ltd. Bank of England (Finsbury Circus): Relay Automatic Telephone Co., Ltd.
Telephone repeater station equipment, Ipswich.—Western Electric Co., Ltd.

Halifax.—Health Committee. Recommended:—
Salvage plant.
Elevating, conveying, and screening plant (£2,375).—Barry, Henry and Cook.
One 225-b.h.p. vertical compound steam engine (£830).—Browett, Lindley and Co., Ltd.
One 150-kW alternator and 13 electric motors (£1,143).—Wright's Motors, Ltd.
One electric capstan (£100).—J. Crossley & Sons, Ltd.

London.—ISLINGTON.—The Synchronome Co.'s system of electric clocks is being installed in the new municipal offices.

Underground Electric Railways Co., of London. Accepted:
E.h.p. cables for the Edgware and Hampstead Railway (£9,720).—W. T. Henley's Telegraph Works Co., Ltd.

HAMMERSMITH.—Electricity Department.
CO_2 recording instruments for the two new boilers (£377).—Cambridge and Paul Instrument Co., Ltd. (Recommended.)

Twelve months' supply of prepayment meters.—Since tenders for the supply of meters were received, the British manufacturers have reduced their quotations for the prepayment pattern. The following schedule shows the original tendered prices and the revised prices:—

	Original Tendered Price.	Revised Tendered Price.
R. T. Durran	£560	£560*
R. Hornby & Co.	625	625*
Landis & Gyr	643	643
Aron Electric Meters, Ltd. ...	772	691†
British Insulated & Helsby Cables, Ltd.	767	727
Ferranti, Ltd. (Recommended.) ...	812	727
Chamberlain & Hookham, Ltd. ...	812	727

* German manufacture.
† Austrian manufacture.

FORTHCOMING EVENTS.

London Association of Foremen Engineers.—Saturday, May 5th. At Cannon Street Hotel. At 6.30 p.m. Anniversary festival.

Institution of Rubber Industry.—Monday, May 7th. At the Engineers' Club. At 7.30 p.m. Paper on "The Use of Rubber Products as Dielectrics," by Mr. W. S. Flight.

Institute of Transport.—Monday, May 7th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "Investigation of the Return on Capital Expenditure Resulting from Electrification," by Sir Philip Dawson, M.P.

Royal Society of Arts.—Monday, May 7th. At John Street, Adelphi, W.C. At 8 p.m. Paper on "The Development of the Steam Turbine," by Mr. S. S. Cook. (Lecture II.)
Wednesday, May 9th. At 8 p.m. Paper on "Recent Developments in Surface Combustion," by Prof. W. A. Bone, F.R.S.

Institute of Physics.—Wednesday, May 9th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Lecture on "The Application of Physics to the Ceramic Industries," by Dr. J. W. Mellor.

Institution of Electrical Engineers.—Thursday, May 10th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Fourteenth Kelvin Lecture, "Problems in Telephony, Solved and Unsolved," by Dr. J. A. Fleming, F.R.S., and presentation of Faraday Medal to Sir Chas. A. Parsons.

(London Students' Section).—Friday, May 11th. At the Institution. At 7 p.m. Paper on "Electrical Measuring Instruments," by Mr. C. A. Wilck.

(Western Centre).—Monday, May 7th. At the Chamber of Commerce, Swansea. At 6 p.m. Paper on "Variable-Speed, Alternating-Current Motors Without Commutators," by Mr. F. Creedy.

Junior Institution of Engineers.—Thursday, May 10th. At the Monico Restaurant, Piccadilly Circus. At 6.30 for 7 p.m. Annual dinner.
Friday, May 11th. At 39, Victoria Street, S.W. At 7.30 p.m. Durham Bursar's Lecture, "The Theory of Resistance to the Flow of Gases and Fluids in Pipes," by Mr. W. F. C. Cooper.

Chemical Society.—Thursday, May 10th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Boyer Memorial Lecture, by Prof. W. H. Perkin, F.R.S.

Royal Institution of Great Britain.—Thursday, May 10th. At Albemarle Street, W. At 3 p.m. Lecture on "Modern Electric Lamps—Glowing Gases (Neon Lamps)," by Prof. J. T. Macgregor-Morris. (Lecture III.)
Friday, May 11th. At 9 p.m. Lecture on "Gaseous Combustion at High Pressures (new experiments)," by Prof. W. A. Bone, F.R.S.

Institute of Engineering Inspection.—Friday, May 11th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper, "Some Notes on 'Ciment fondu'—a cement of high initial resistance—with Results of Chemical Analyses," by Mr. H. F. Knight.

Physical Society of London.—Friday, May 11th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Guthrie Lecture, "The Present Position of the Radiation Problem," by Mr. J. H. Jeans, Sec. R.S.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

WE have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following devices are asked for:—

TRIANGLE domestic irons.
PREMIER-AMPERO charging device for wireless or other batteries.
PERLUX electric hand lamps.

NOTES.

Underground Cables at 150,000 Volts.—Correction.—On page 649 of our last issue, left-hand column, lines 54 and 55 should read :—

kW loss with 12 cables (50,000 V)=1,070 kW;
kW loss with 4 cables (150,000 V)=1,300 kW.

Lecture.—On April 24th, Mr. S. T. Allen, borough electrical engineer of Wolverhampton, lectured at the local Rotary Club upon the electricity undertaking. He said that since its inception the undertaking had not cost the ratepayers (as such) a single penny. The capacity of the plant was equivalent to 30,000 h.p., and it was being increased to 40,000 h.p. The area covered by the Corporation's electricity supply was 15,000 acres, and there were 5,400 premises connected to the mains. Over 20,000 h.p. of motors was connected, and, at times, the domestic load was equal to 2,000 h.p. Apart from its contributions as a ratepaying institution, the undertaking had devoted £22,000 to the relief of the rates.

A Large Radio Demonstration.—A demonstration of "Gecophones" was recently organised by the General Electric Co., Ltd., Kingsway, on the occasion of the broadcasting of the pantomime "Cinderella." Five inside aerials were erected in the lecture hall at Magnet House, and to these and to a number of electric light attachments were connected 36 "Gecophone" receiving sets, including two-valve sets, and the No. 1 and No. 2 crystal sets. To these sets were connected, in all, some 150 pairs of double headgear telephone receivers, together with additional loud-speaking equipment. The latter was in operation during intervals in the programme, and a large number of the company's trade friends were able to compare results obtainable with the various types of apparatus.

The Lighting of St. Mary's Church, Stoke Newington.—An interesting example of the conversion of a gas lighting installation to electric lighting has recently been completed in the Cathedral Church of St. Mary, Stoke Newington, London. The original equipment in the nave and choir comprised 16 ring fittings carrying upright incandescent gas mantles; these fittings have been rejuvenated at small cost, and adapted for use with electric gasfilled lamps, of which four of 100 W each are suspended from each ring, in Holophane globes. The

illumination obtained with gas was extremely poor, averaging 0.5 ft.-candle at the reading level, whilst the upper part of the building was shrouded in gloom; with the new system the illumination ranges from 3 to 0.8 ft.-candle, with an average of more than 1.5 ft.-candles, and the architectural features of this fine church are admirably displayed. The chancel is lighted by means of lamps carried on brackets in the angles of the windows on the north and south sides, the fittings being so arranged that the congregation is not afflicted with glare; two 100-W pip-frosted lamps are fixed on each side, and the illumination obtained at the middle of the choir stalls, formerly 0.7 ft.-candle, now reaches a maximum of 7.5 ft. candles. The reredos, an exceptionally artistic representation of the Last Supper, within an arcade, presented great difficulties to the wireman, which had to be overcome by the exercise of great care and skill; it is lighted with concealed carbon lamps, producing a pleasing mellow glow which sets off the group of statuary to great advantage. The lectern, which is provided with a specially designed fitting, now receives an illumination of 1.0 ft.-candle—formerly 0.4. The transepts are lighted with bracket fittings by Messrs. Galsworthy, of which an illustration is given herewith.

A novel item is the use of signal lamps with which the organist, who is situated out of sight of the choir, gives the time to the singers; these consist of two green 40-W lamps, fixed on either side of the chancel arch, and invisible from the nave, and are actuated by a push button on the console of the organ, near the stops. Owing also to the situation of the organist, difficulty was formerly experienced, in the case of processional hymns, in telling him when the choir entered the church by the south or the west door; this has been surmounted by the use of signal lamps at the organ, controlled by push buttons at the respective doors.

The installation comprises a total of 9 kW, and has been carried out on the three-wire system at 240 and 480 volts, d.c., the load being balanced as nearly as possible. The wiring is in solid welded conduit throughout. Two 9-way distributing boards are fixed near the west door, controlling the lighting in the body of the church, the aisle circuits being subdivided so that the illumination can be regulated.

The contractors were Messrs. H. M. Leaf, and Callender 2,500-megohm C.M.A. cables were used; the fuseboards are Messrs. Tuckers', the main ironclad switches and fuses M.E.M. Co., local switches by Lundberg, and the fittings by Messrs. Galsworthy. The installation was carried out to the designs and under the supervision of Mr. F. H. Taylor, A.M.I.E.E., to whom we are indebted for the particulars here given.

The Air Defence of London.—The formation of two Air Defence Brigades, Territorial Army, has been authorised in London, each brigade comprising Artillery, Engineers, and Signals, with co-operating aircraft. An effort is being made to bring the units up to strength, with the right type of men, as quickly as possible, in order that the greatest benefit may be obtained from this year's camp in August, and also to improve the facilities for defence against aerial attack. We reproduce below a letter which is being sent to a number of firms in the vicinity of London; as it is not possible, however, directly to circularise every employer and employé, we have much pleasure in giving it publicity, so that the existence of these brigades, and of this R.E. battalion in particular, may be made known as widely as possible :—

Duke of York's Headquarters,
Chelsea, S.W.3.
April, 28th 1923.

Gentlemen,

In view of the widespread publicity which has of late been given to the state of the air defences of our country and the imperative need for definite action in regard thereto, I take this opportunity of addressing your firm in the interests of recruiting.

A vivid recollection of the havoc caused by air raids in the late war should prove a sufficiently strong incentive to come forward in the case of many who must realise that air defence and home defence are now practically synonymous terms.

It is possible that an appeal in this direction may have been made to you already; I should nevertheless be glad at any time to explain to your staff personally the general rôle of the new Territorial Air Defence Formation for the protection of London, with the hope of raising an entire unit from the personnel of your firm.

It is hoped that such a unit, if raised, would be closely identified with the name of the firm to which it owed its origin, so retaining essentially its own *esprit de corps*, and combining in its formation a patriotic and industrial enterprise of the first importance.

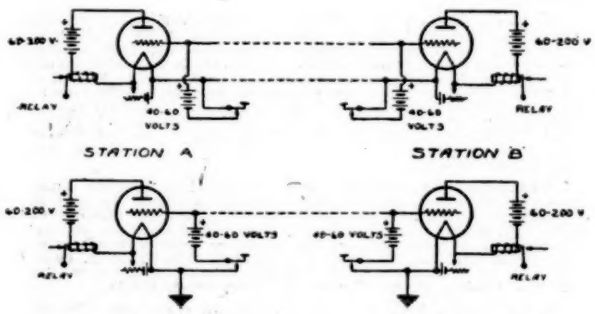
Yours faithfully,
(Signed) D. Howard Gill,
Colonel,
Commanding 2nd Air Defence Brigade (T.A.).

Appointments Vacant.—Senior assistant electrical engineers (£225 to £241), for the Newcastle-upon-Tyne Electric Supply Co., Ltd.; assistant electrical engineer (£760), for the Tientsin Municipal Council; power-house engineer (£540), for the Government of Gold Coast; electrical meter mechanic (75s.), for the Salford Corporation Electricity Department; constructional engineer (£800), for the Yorkshire Electric Power Co.; junior engineer draughtsman (temporarily), for the Southern Railway (S.W. Section); assistant professorship in electrical engineering, for the City & Guilds (Engineering) College, S.W.7. (See our advertisement pages to-day.)

Electric Vehicle Demonstration Charges.—The Electric Vehicle Committee of the Society of Motor Manufacturers and Traders has recently been considering the question of standard charges to be made in respect of demonstration trials given to probable purchasers of industrial electric vehicles. The Society has now agreed upon the following charges for such demonstrations: Half-tonners, £5; for 1 to 1½-tonners, £7 10s.; for 2 to 2½-tonners, £10; and for 3-tonners and over, £12. Members of the Society are recommended to keep to the scale adopted, on the understanding that not more than two days' free demonstration be allowed.

The Audion Morse Relay.—Among the various problems which present themselves to telegraph engineers, are those connected with the failure of Morse-operated lines due to excessive leakage, and the difficulty experienced in the use of high-resistance lines. Since in certain radio uses of the audion it is employed as a potential-operated device, it was thought that possibly one might combine the audion with an ordinary relay, in such a manner that Morse operation might be effected by means of potential applied to the line, rather than by the current in the line. The fact that the audion, when operated as a relay, functions without inertia, is an advantage in this connection. Work was begun on the problem early in 1921, by the Canadian Radio Corporation, Ltd., and has now progressed to the point where there is considerable promise of a practical operating organisation being available.

The accompanying illustration shows two typical circuits, which may be used for Morse traffic, one a full metallic circuit and the other a circuit having an earth return. The audion, when functioning as a Morse relay, operates on "open circuit," and upon closing the key at station A there will be impressed upon the grid of the audion relay at that station a definite predetermined positive potential, and the



space current will instantly rise to a value which will give positive operation to the Morse relay in the plate circuit of the electron or audion relay. This procedure simultaneously impresses upon the grid of the audion at the distant station B, a like potential (except for the slight fall of potential due to the resistance of the line), and the distant audion relay will function in a manner similar to that at station A. At both terminals the local Morse relay in the plate circuit may be adjusted so that they will be operated as "closed" or "open" organisations, as convenience dictates.

Since in using this device the line current is only from 1 to 5 milliamperes and since the resistance of the signalling circuit is chiefly due to the grid-to-filament resistance of the tubes, the resistance of the physical line itself is of secondary importance.

It would appear that lines of iron wire will function satisfactorily and that the audion relay, when operated over standard copper lines, will give satisfactory commercial service over lines up to 800 and possibly 1,000 miles without repeaters. Interference with adjacent telephone circuits is reduced to a negligible quantity; it is also possible to establish either a simplex or composite circuit, without the use of the usual retardation coils and condensers, and in a trial over actual lines, telephone relays were operated while conversation was in progress, and practically no sound could be detected in the telephone circuit.

While the audion has certain marked advantages over the ordinary relay, it may prove to have certain limitations. Positive potentials induced in the lines from extraneous sources, may tend to result in abortive operation of the relay. However, so far this phenomenon has not presented itself, and notwithstanding such possible limitations, we have in this new application of the audion a device which will undoubtedly assist in the improvement of Morse operation.—*T. & T. Age.*

Cup Final Celebrations.—Our readers have probably read sufficient about the Football Cup final in their daily papers, and we thought that we should escape the necessity of referring to it. The Siemens & English Electric Lamp Co., however, draws our attention to one method of celebrating the event, which was arranged by the West Ham Corporation Tramways Department. One of the department's cars was decorated with drapings and 2,000 Siemens traction lamps in appropriate colours. Upon the return of the West Ham players this car preceded their conveyance in a kind of triumphal procession.

Patent Restorations.—Orders have been made restoring the following patents:—No. 174,064, of 1916, granted to Albert Van Tuyl Day for "Improvements in or relating to electric high-frequency signalling"; and No. 137,311, of 1916, granted to L. E. & W. C. Connelly for "Improvements in water-tube steam generators."

INSTITUTION NOTES.

Institution of Electrical Engineers.—South Midland Centre.—The annual general meeting was held on April 25th, when the Committee's report for the 1922-23 session was presented. This shows that a very full programme of meetings and excursions has been got through. The membership increased during the session from 796 to 854. The chairman for the ensuing session is Mr. J. D. Morgan, M.Sc., and the vice-chairmen Messrs. W. Lawson and J. Anderson.

Western Centre Summer Meeting.—Owing to unforeseen circumstances, it has unfortunately been found necessary to postpone the summer meeting of the above Centre from May 25th/28th to June 1st/4th.

Mersey and North Wales (Liverpool) Centre.—The annual general meeting of this newly-formed Centre was held at Liverpool on April 27th, when the following Committee for the 1923/24 session was elected:—*Chairman*: E. M. Hollingsworth. *Vice-Chairmen*: H. H. Harrison, A. E. Malpas. *Committee*: L. Breach, J. Hamilton, W. Lang, P. Priestly, A. J. Eames, J. A. Morton, E. Moxon, F. J. Teago, S. E. Britton, H. C. Hazel, W. Holttum, R. Harrison-Watson. *Hon. Secretary and Treasurer*: Mr. O. C. Waygood. The meeting was followed by a smoking concert, the following artistes rendering various items:—Mr. Roy Taylor, solo pianist; Mr. Jack Wright, baritone; Mr. John Lindop, tenor; Mr. Montague Watson, banjoist; Messrs. Joe Canavan and Tom Smith, humorists.

Scottish Centre.—Forty representatives attended the annual gathering of the Scottish Centre of the Institution in Dundee on April 27th. A paper by Messrs. I. Breach and H. Midgley, Liverpool Corporation, on "The Drive of Power-station Auxiliaries" was followed by a discussion, taken part in by Mr. D. H. Bishop, Dundee, Mr. R. B. Mitchell, Glasgow, and Mr. J. C. Christie, Arbroath. Places of interest in Arbroath were visited, and the Arbroath Electric Light Co. extended hospitality. Arrangements for the gathering were carried out by Mr. William Frain, hon. secretary of the Dundee Sub-Centre.

Informal Meetings.—On April 23rd, at the final meeting for the session of the Informal Section, Mr. E. W. Moss was in the chair, when Mr. E. Shaughnessy opened a discussion on "Practical Broadcasting." He remarked that he was speaking as a private individual, and explained the problem the authorities had been faced with owing to the requirements of the fighting services and shipping, which resulted in the allotment to the general public of the range of wave length from 350 to 425 metres—equalling 150 kilo-cycles.

Mr. Shaughnessy dealt with some of the sources of interference, and described a tuned anode circuit that eliminated the tendency to oscillate. He was not hopeful of detecting the offenders, and appealed for honourable compliance with the regulations by the holders of experimental licences.

Capt. Eckersley thought the wave band allotted was a very good one, but it had a most distinct shielding effect. At longer wave lengths crystal sets would be less successful, but they were too considerate of the cheap apparatus, and progress demanded that the wave should be extended. As microphones improved, taste would expect clearer reception, and all tendency to oscillate would be dealt with.

Mr. J. Scott Taggart thought the present conditions too irksome for the experimenter and amateur enthusiast. If the public was to be satisfied listeners should be able to switch over to different stations and select their programme.

Fourteen other speakers took part in the discussion.

Royal Institution.—The annual meeting of the members was held on May 1st, Sir James Crichton-Browne, vice-president, in the chair. The annual report of the Committee of Visitors for the year 1922, testifying to the continued prosperity and efficient management of the Institution, was read and adopted, and the report of the Davy Faraday Research Laboratory Committee was read. Sixty new members were elected in 1922, and 63 lectures and 19 evening discourses were delivered. The following gentlemen were elected as officers for the ensuing year:—President: The Duke of Northumberland. Treasurer: Sir James Crichton-Browne. Secretary: Sir Arthur Keith.

Edinburgh Association of Mining Electrical Engineers.—At the annual meeting of the Association the following office-bearers were elected:—*President*: Mr. G. A. McLennan. *Vice-Presidents*: Mr. E. Cunningham and Mr. A. Finlay. *Hon. Secretary*: Mr. James Walker. *Hon. Treasurer*: Mr. John Adam.

Institution of Engineering Inspection.—On April 20th, Mr. C. H. Richardson, B.Sc., read a paper upon "The Inspection of Ball Bearings," in which the process of examination was very fully treated. On May 11th, at the Royal Society of Arts Building, John Street, W.C., Mr. H. J. Davey, M.B.E., is to read a paper entitled "Some Notes on 'Ciment Fondu'—a cement of high initial resistance—with results of Chemical Analyses by Harley F. Knight, F.I.C."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. N. BROOKSBANK, A.M.I.E.E., has resigned the position of chief technical assistant in the Ipswich Electricity and Tramways Department in order to take up an appointment with the Victoria Falls and Transvaal Power Co., at its London office.

Mr. W. J. FURSE, J.P., of W. J. Furse & Co., Ltd., Nottingham, has been elected chairman of the Basford Board of Guardians for the twenty-third time.

In connection with the resignation of Mr. G. W. HOLFORD, the general manager of the Salford Corporation tramways, which took effect as from May 1st, 1923, the Tramways Committee recommends that his salary be paid up to August 1st, 1923, and that the sum of £300 be paid to him as a retaining fee in connection with any service required from him by the Committee.

Mr. W. PROVOST, electrical accessories manufacturer, has been elected a member of the Birmingham City Council for St. Mary's ward.

Mr. P. E. PERONNE, who, as mentioned in this column last week, was the winner of the first prize in the "All-Electric House" competition, has had experience in connection with battery manufacture and with installation work in India. He is at present, and has been for some years engaged as an engineer with Messrs. Marryat & Place, electrical engineers, of Hatton Garden. Mr. Peronne acknowledges the aid of his assistant, Mr. Arden, in connection with the contest.

We understand that the Council of the Institute of Transport has elected Sir J. G. BROODBANK as president for the year beginning October next. Mr. A. Winter Gray has been appointed secretary of the Institute from that date, when Mr. H. E. Blain will relinquish the office of hon. secretary and become a vice-president.

Mr. ARTHUR MARKS, F.I.C., A.R.C.Sc., &c., has been appointed as metallurgical adviser to Messrs. A. Harper, Sons and Bean, Ltd., of Dudley. He has been for the past seven years metallurgist and head of the testing department of Messrs. Harland & Wolff, Belfast.

Mr. T. D. CLOTHIER, Mrs. Clothier, and their family, bade farewell to Bootle on Monday, when they left for Glasgow. They will sail from that port on May 6th, aboard the Holt liner *Ascanius*, for South Africa, where they intend making an extended tour prior to settling in that country. The officials at the Bootle Town Hall presented a case of cutlery to Mr. Clothier.

Obituary.—MR. F. A. DONNISON.—We regret to learn from the *Electrical Contractor* that Mr. Fred A. Donnison, who was with Messrs. Girdlestone & Co., and formerly of the firm of Donnison, Sillem, Berlyn & Co., whom he represented at the E.C.A. meetings twenty years ago, has passed away after nine months' illness.

NEW COMPANIES REGISTERED.

Northern Radio Co., Ltd. (189,342).—Private company. Registered April 19th. Capital, £5,000 in £1 shares (2,500 7½ per cent. cumulative participating preference and 2,500 ordinary). To carry on the business of electrical, mechanical, and general engineers, manufacturers of, and dealers in electrical and other machinery, radio instruments and wireless apparatus, &c. The first directors are:—J. Joseph, M.I.E.E., 50, Handen Road, Lee, S.E.12, radio engineer (chairman and permanent director); G. W. Tempest, 9, Green Bank Terrace, Heaton Norris, Stockport, radio engineer. Registered office: 19, Hopwood Avenue, Market Place, Manchester.

Nox Electric Lamp Co., Ltd. (189,377).—Private company. Registered April 20th. Capital, £2,000 in £1 shares. To take over the business carried on by W. Ellis and H. Wooldridge at 82, Albion Street, Leeds, as the "Nox Electric Lamp Co." The first directors are:—W. Ellis, "The Bungalow," Pudsey, Yorks., wholesale clothier; H. Wooldridge, 22, Mexborough Drive, Chapeltown Road, Leeds. Qualification, 100 shares. Secretary: A. J. Fenton. Registered office: 82, Albion Street, Leeds.

Technical Instrument Case Manufacturing Co., Ltd. (189,453).—Private company. Registered April 23rd. Capital, £1,500 in £1 shares. To take over the business of technical instrument case and box manufacturers, carried on as a subsidiary business by the Re-Echo Electrical Manufacturing Co., Ltd., at 43, Johnson Street, Westminster, and to carry on the same and the business of cabinet makers, joiners, carpenters, &c. The permanent directors are:—Capt. W. R. Hargroves, M.B.E., 12, Strawberry Hill Road, Twickenham; J. B. Bignamy, 92, Gloucester Street, S.W.1; Capt. C. W. Dann, M.C., Great Chalvedon Hall, Pitsea; W. Taplin, 187, Holland Road, Willesden. Registered office: 43, Johnson Street, Horseferry Road, Westminster, S.W.

Phillips & Sons (Chiswick), Ltd. (189,547).—Private company. Registered April 26th. Capital, £1,000 in £1 shares. To adopt an agreement with W. J. Jackson and H. Dubbury, trading as "Phillips and Sons," and to carry on the business of electrical, mechanical, and general engineers, manufacturers and workers of, and dealers in electricity, motive power and light, &c. The permanent directors are:—H. Dubbury, 35, Barclay Road, Walham Green, S.W.6; W. J. Jackson, 297a, High Road, Chiswick, W.4. Qualification, £100. Secretary: H. C. Mundy. Registered office: 403, High Stueet, Chiswick, W.4.

Pickford, Johnson & Co., Ltd. (189,401).—Private company. Registered April 20th. Capital, £2,500 in £1 shares. To acquire the business carried on by L. Johnson and E. H. Pickford in Sheffield, and to carry on the business of designers, instructors, patentees, licensees, demonstrators, wireless service operators, photographers, draughtsmen, and makers of and dealers in receiving and transmitting sets, components of wireless installations and equipment, armatures, vacuum and thermionic tubes, voltmeters, &c. The first directors are: Lawrence Johnson, 125, Hindehouse Lane, Sheffield, electrical engineer; J. H. Pickford (chairman), 6, Westgate, Rotherham, solicitor; E. H. Pickford, 262, Eccleshall Road, Sheffield, motor engineer; F. A. Camm, 266, Eccleshall Road, Sheffield, accountant; G. W. Alcock, jun., Totley Rise, Sheffield, motor engineer. Qualification, £50. Remuneration as fixed by the company. Registered office: 262, Eccleshall Road, Sheffield.

J. B. Saunders (1923), Ltd. (189,434).—Private company. Registered April 23rd. Capital, £3,000 in £1 shares. To carry on the business of electrical, mechanical, and general engineers, metal workers, founders, manufactures of, and dealers in electrical, wireless, and other apparatus, &c. The subscribers (each with one share) are:—J. H. P. Berthon, "Drynhyfryd," Lisvane, Cardiff, engineer; H. B. Hann, Baltic House, Cardiff, solicitor. The permanent directors are:—J. H. P. Berthon and one other to be appointed by the subscribers. Qualification, £500. Remuneration as fixed by the company. Registered office: 10, Park Lane, Cardiff.

A. E. G. Machinery and Apparatus Co., Ltd. (189,461).—Registered as a private company on April 24th, with a nominal capital of £10,000 in £1 shares. The objects are:—To carry on the business of manufacturing, constructional or consulting electrical, gas, hydraulic, mining, civil, marine, and mechanical engineers, founders, manufacturers of and dealers in machinery of all kinds, and any other business, manufacturing or otherwise, which may seem capable of being carried on in connection therewith or calculated to enhance the value of the company's property and rights for the time being, provided that so long as any restrictions are by law imposed in respect of "key industries," the company shall not be concerned therein, except in pursuance of any necessary licence or consent first obtained. The first directors are:—R. T. Durran, 76, Victoria Street, Westminster, S.W.1 (director, Skefko Ball Bearing Co., Ltd.); J. E. Percival, C.A., 6, Old Jewry, E.C. No qualification required. Remuneration as fixed by the company. The registered office is at 76, Victoria Street, Westminster, S.W.

E. E. E. Carbon Co. (189,425).—Registered as a private company on April 23rd with a nominal capital of £6,000 in £1 shares (5,000 6 per cent. cumulative participating preference and 1,000 ordinary). To act as agents for Gebr. Siemens & Co., Berlin, in the sale of carbons and other articles manufactured by them; to carry on the business of electricians, electrical and mechanical engineers, &c. The subscribers are:—C. Leven, M.I.E.E., 109-111, New Oxford Street, W.C.1, electrical engineer (1,000 ordinary and 5 preference shares); L. J. Hitchcock, 849, Harrow Road, N.W.10, electrical engineer (4,995 preference shares). The first directors are to be appointed by the subscribers. Registered office, 109-111, New Oxford Street, W.C.

Wholesale Equipments, Ltd. (189,491).—Private company. Registered April 24th. Capital, £2,000 in £1 shares. To carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, engineers, brassfounders, gas and electric meter manufacturers, &c. The subscribers (each with one share) are:—R. W. Nicholas, 31, Queen Street, Cardiff, solicitor; E. F. Evans, 31, Queen Street, Cardiff, solicitor. The subscribers are to appoint the first directors. Solicitor: R. W. Nicholas, 31, Queen Street, Cardiff.

E. M. Bates, Ltd. (189,349).—Private company. Registered April 19th. Capital, £1,000 in 950 10 per cent. cumulative participating preference shares of £1 and 200 ordinary shares of 5s. each. To acquire the business of an agent for electric washers, ironers, vacuum cleaners and drying machines now carried on by E. M. Bates at 61, High Street, Manchester. The subscribers (each with one preference share) are: T. E. Clarke, 15, Rooke Street, Manchester, bleacher; J. H. Holt, Lower Walshaw, near Bury, cotton manufacturer. The first directors are not named. Qualification, 50 preference or ordinary shares. Registered office: 37, Cross Street, Manchester.

Gem Labour Saving Device Co., Ltd. (189,350).—Private company. Registered April 19th. Capital, £3,000 in £1 shares. To acquire (1) the business of a manufacturer and agent of commercial and household labour-saving devices, vacuum cleaners (electrical and hand operated), electric washing machines and carpet sweepers, now carried on by F. Taylor, trading as the "Gem Labour Saving Device Co.," at 60, Long Millgate, Manchester; and (2) the business of yarn agents, and agents for all classes of sponge cloths, scourers, dusters and towelling carried on by Allen and Joseph Horrocks, trading as "A. and J. Horrocks," at 1, Fennell Street, Manchester. The subscribers (each with one share) are: F. Taylor, 60, Long Millgate, Manchester, manufacturer and agent; C. Howard, 33, Princess Street, Manchester, solicitor. The subscribers are to appoint the first directors. Remuneration as fixed by the company. Secretary: F. Taylor. Registered office: 60, Long Millgate, Manchester.

Midland Radio Telephone Manufacturers, Ltd. (189,317).—Private company. Registered April 18th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers and merchants of all kinds of telegraphic, telephonic and wireless apparatus, &c. The permanent directors are: A. E. R. Harris (governing director and chairman), no address given; C. Furber, Town Mills, Lower High Street, Stourbridge, manufacturer; C. H. Gardner, Amblecote House, Brierley Hill, electrical engineer. Qualification, £50. Remuneration as fixed by the company. Registered office: Brettell Lane Works, Stourbridge, Worcestershire.

Stafford Radio Co., Ltd. (189,532).—Private company. Registered April 26th. Capital, £2,000 in £1 shares. To adopt an agreement with B. A. Colman and to carry on the business of manufacturers of, and dealers in apparatus of all kinds, capable of being employed in wireless telegraphy and telephony. The first directors are:—B. A. Colman, Junior Army and Navy Club, Whitehall, S.W.; V. G. Burch, 2, Park Mansions, St. Paul's Avenue, Willesden Green, N.W.2. Registered office: 150, Southampton Row, W.C.1.

Armstrong Construction Co., Ltd. (189,391).—Registered as a private company on April 20th, with a nominal capital of £250,000 in £1 shares. The objects are: To acquire the property referred to in a certain agreement, the parties to which are not named; and to carry on the business of constructional, mechanical, civil, electrical, chemical, hydraulic, pneumatic, gas, aerial, mining, railway, tramway, naval, marine, heating, lighting, ventilating, and consulting engineers, ironmasters, bridge and dock gate builders, &c. The subscribers (each with one share) are: H. Harrison, 8, Great George Street, S.W.1, financial secretary; C. O. Ridley, 8, Great George Street, S.W.1, civil engineer. The subscribers are to appoint the first directors. Qualification, £500. Remuneration, £150 each per annum (chairman, £250), free of income tax. The registered office is at 8, Great George Street, Westminster, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Robins Electrical and Wireless Depôt and Institute, Ltd.—Debenture dated April 17th, 1923, to secure £2,148, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. W. Robins, "Walbrook," Cyncoad Road, Cardiff.

Surrey Engineering Co., Ltd.—Particulars filed of £1,500 debentures authorised March 12th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Paignton Electric Light and Power Co., Ltd. (98,437).—Return dated March 20th, 1923. Capital, £40,000 in £1 shares. 30,000 shares taken up. £30,000 paid. Mortgages and charges, £6,500 mortgage debentures.

Yorkshire (West Riding) Electric Tramways Co., Ltd. (84,167).—Return dated March 16th, 1923. Capital, £600,000 in 70,000 preference and 50,000 ordinary shares of £5 each. 46,261 preference and 40,977 ordinary shares taken up. £436,190 considered as paid. Mortgages and charges, £272,373.

Flactem Wireless, Ltd.—Particulars filed of £1,000 debentures authorised March 16th, 1923, and covered by trust deed of even date, charged on the company's undertaking and property, including uncalled capital, the whole amount being now issued. Trustees: J. Vine, Pearl Chambers, East Parade, Leeds; and H. Turtle, 7, Park Square, Leeds.

P. R. Jackson & Co., Ltd. (35,232).—Return dated April 11th, 1923. Capital, £60,000 in £1 shares. All shares taken up. £1 per share called up on 11,410 and 6s. per share on 19,000 shares. £17,110 paid. £42,830 considered as paid, being £1 per share on 29,590 and 14s. per share on 19,000 shares. Mortgages and charges, nil.

Sunderland District Electric Tramways, Ltd. (79,054).—Return dated February 13th, 1923. Capital, £151,012 in 4,505 non-cumulative 6 per cent. preference shares of £1; 95,495 non-cumulative 12 per cent. preference shares of 10s.; 95,010 ordinary shares of £1; and 74,990 ordinary shares of 1s. each. 95,495 preference and 74,990 ordinary shares taken up. £51,497 paid. Mortgages and charges, £216,065 19s. 2d.

Teignmouth Electric Lighting Co., Ltd.—Issue on April 16th, 1923, of £100 debentures, part of a series already registered.

CITY NOTES.

English Electric Co., Ltd.

The annual meeting was held on April 25th, Sir Charles Ellis, G.B.E., K.C.B., presiding.—In moving the adoption of the report, the chairman referring first to the balance sheet, said that on the assets side the item land, buildings, plant, machinery, &c., showed an increase of some £75,000. That increase represented certain essential capital expenditure at the several works. While trade conditions remained as they were at present and had been for the past two years, it was their policy to restrict such commitments to the very minimum compatible with efficiency. Stocks and work-in-progress stood at £366,000 less than in 1921, and that decrease was also to a great extent explained by their policy of keeping down stocks to the lowest possible level. It might appear strange at first sight that, with restricted trade conditions generally, the assets, sundry debtors and debit balances, should only show a decrease of some £60,000, as compared with the figure for 1921. He might explain, however, that the 1922 figure included a sum of no less than £691,000, representing cash and British Government securities. They would see, therefore, that the financial position was an exceedingly strong one. On the liabilities side of the balance sheet there was a reduction of approximately £30,000 in the company's debenture commitments, representing the annual redemptions under the sinking fund, while sundry creditors and credit balances were some £275,000 less than last year. The profit and loss account showed an available balance, including the carry forward from last year, of £318,264, as compared with £363,659 for the previous year. He thought they would agree that that was a satisfactory result, bearing in mind the fact that from one cause and another the year was one of the worst which the engineering trade had ever experienced. After paying the prior charges and the fixed dividend upon the preference shares there remained an available balance of £125,088, out of which they proposed to appropriate £56,105 for payment of an ordinary dividend for the year at the rate of 5 per cent., less tax, and to carry forward to next year the balance of £68,982, as against a balance of £55,599 brought forward from 1921. When addressing them last year he emphasised the need for prudence and the avoidance of too optimistic an attitude. Subsequent events had justified the prediction that the upward lift of trade, although steady, would be long and tedious. They were aware that the company's main productive activities were centred in five works. Although factories scattered in this way were perhaps more difficult to organise than if they had been centred in one place, yet there was about that arrangement an elasticity which made it possible more easily to adjust their working productive capacity to meet abnormal trade situations. It enabled them, for example, to effect, with the maximum of advantage and the minimum of disturbance, what might otherwise have seemed the too-drastic economy of concentrating on four of their factories and temporarily closing down the fifth. Not only was there the direct saving, but the production efficiency in the other works was thus improved as a result of the additional turnover diverted to them. Three of them were now fully employed and the fourth was within sight of full employment, whilst in the one which was closed down establishment charges had been reduced to a negligible amount. The orders received during the year under review were in value 1¾ times those received in the previous year, but they still required more work in order to be really comfortable. The order book in the later months of the years showed a steady increase, and in the first three months of this year the improvement had been more than maintained. Some sections of the business were busier than others, and it was to a more steady average in each department that they looked for complete success. He told them last year that, on the technical side of the business, improvements in existing designs and the development of new lines of machinery had been pursued with ceaseless activity. The same policy had been followed with even greater intensity, if possible, throughout the year under review, with the result that many of their improved designs and manufactures which were last year in the stage of proving themselves had since become definitely established and large contracts had been obtained, particularly in electric railway work and general water-power business. In connection with railway electrification, the development of the company's new camshaft control had been of great importance. Equipments embodying that system had been installed or were being built for electric railways in all parts of the world. A number of electric locomotives with that form of control had recently been put through exhaustive tests on the Midi Railway of France, and they had given entire satisfaction and were now in regular operation on the lines in the Pyrenees. Motor-coach equipments, the type of equipment required for suburban and other local passenger traffic, had already been tested on the Cataluna Railway in the neighbourhood of Barcelona, and would shortly be working on the Midi Railway of France, on light railways in Holland, and on the lines of a number of railway companies in Japan. The Japanese Government Railways, after an inquiry extending over years, into the different systems in use on electric railways, decided to adopt the high-pressure d.c. system, and during 1922 they placed a contract with the company for 34 electric locomotives for freight and passenger traffic on one of their main lines. More recently they had secured the contract for the electrical equipment required by the Great Indian Peninsula Railway in connection with the electrification of the suburban lines in and near Bombay—the first railway electrification to be undertaken in India. Important progress had also been made in another branch of the company's activities, the supply of plant for water-power development. Electrical generating plant driven by water turbines had been built by the company or its predecessors for many years, and might be found in operation in all parts of the world. But the construction of the turbines themselves and of the apparatus incidental to them had in the past been to a great extent a close preserve of Continental and American manufacturers. They now had under construction large water turbines for both high and low falls. For India they were building a 15,000-h.p. turbine, fitted with a patent governing device and balanced valve, for working under a head of 1,650 ft., whilst for Brazil they had obtained an order for a 25,000-h.p. reaction turbine and alternator. Both of those contracts were secured in the face of keen world competition. In view of the plans which were on foot to develop water-power resources in all those parts of the world where they were abundant, they looked to the progressive extension of that side of the company's business. In this country, and in many others, the steam turbine and the internal combustion engine were likely to remain the principal prime movers in use for the generation of electricity. In the year under review they completed the revision of their designs both of steam turbines and turbo-alternators, and they had under construction sets both large and small which in efficiency and modernity of design were in the first rank. In December, the new power station of the Leicester Corporation, constructed and equipped by the company under a comprehensive contract, was formally opened, and during the year a similar contract was obtained for the new station of the Preston Corporation, which would contain in the first instance two 10,000-kW sets of their latest design running at 3,000 r.p.m. In the field of internal combustion engines, they had developed, as an extension of their standard range of Diesel engines, the Fullager opposed-piston engine for land purposes. That engine, which had the advantage of greatly reduced weight and size for a given horse power, was running entirely satisfactorily and had been adopted by Messrs Cammell Laird, who manufactured the Fullager engine for marine purposes, for driving the generators of the electrically propelled ships which they had under consideration. They had spared no effort to extend old markets and to create new ones for the company's products. In pursuance of that policy their engineer-in-chief was at the present moment in New Zealand, working on a number of large water-power projects, whilst their export manager had recently returned from a visit of five months to India. He had come back full of confidence in the revival of trade and in the rapid growth of the demand for their products throughout the Indian Empire. Mr. W. L. Hichens, deputy chairman, seconded the motion which was adopted after a short discussion.

British Electric Transformer Co., Ltd.

The annual meeting was held on May 1st at Winchester House, E.C. Mr. A. F. Berry presided, and in proposing the adoption of the report, he stated that the net profit for the year was less than that of the previous year by about £71,000. Proceeding to explain at length the reason for this falling off in net profits, Mr. Berry said that at the last annual meeting they realised that the prospects of making money were poor, and he then stated that the time was not very far distant when the strong confidence of the shareholders would be needed to help them over the one or two years during which it might be impossible to produce the splendid results to which they were accustomed. He also told them that when they started the year 1922 they had roughly 60 per cent. less work in hand than they had at the beginning of 1921, and that those orders

in hand would not carry the same ratio of profit as they had been in the habit of receiving. The results of the trading for 1922, poor as they might appear to shareholders, were really not so very disheartening to those of them who, although they had to forgo any dividend on their ordinary shares, knew how great had been the difficulties with which the board had had to contend. Not only had there been a shortage of work, which shortage in turn forced down prices to an unremunerative limit, but they had a lock-out of one month's duration. That stoppage did not mean merely that they obtained 11 months' output for 12 months' expense, but it affected them in a number of ways and for a long time. Owing to the conservative policy adopted by the directors in the allocation of the profits for the year 1921, they were able to bring into their available balance this year no less a sum than £12,708, making a total available balance of profit for the period under review of £33,137 odd. That enabled them to pay the 7 per cent. dividend on the preference shares for the year in full, to place a further sum of £4,000 to depreciation reserve, and to carry forward to next year a balance of £8,137. Shareholders would naturally wish to understand, as clearly as possible, what the real position was and the true meaning of the comparatively poor results of trading with which they were at present faced. At their last annual meeting he explained how remote were the possibilities of a dividend on the ordinary shares for this year. By some that prophecy was perhaps considered too pessimistic, but the year's results had justified the warning then given. Although the present found them, in common with many others in industry, dealing with a most difficult period of their existence, he had no doubt they would win through. A company's history had a habit of repeating itself. Most of the shareholders were well aware of the company's long and successful past. They had through the last 25 years developed the business steadily in spite of ups and downs, and although they showed the biggest profits in 1921, that year was in fact probably the most dangerous one through which they had come, owing to the risk of being left with high-priced and heavy stocks of partly-finished material. It was largely because of their successful past that they were by sheer momentum going forward at the present time. They were now fording a stream of difficulties such as they had never been confronted with. He feared that it would take them the greater part of this year to get themselves on to *terra firma*, and those of them who were responsible on the board, in offices and works, for getting on to the high road to prosperity would again need the confidence and support of the shareholders as much as ever. With regard to the future, it would certainly be well into next year before they were able to reach a profit-earning stage that would permit any appreciable distribution to holders of ordinary shares; for although they were able last year to produce a profit, that was rather the result of work carried forward than the result of the prices obtained during the year under review. During the present year it would be difficult to produce results as good as those even for the past year, for although the actual volume of business was now growing and orders to date amounted to more than for the first four months of last year, they had virtually come very near to giving two halfpence for one penny. The volume of the world's work having shrunk, buyers had been exigent to an unprecedented degree, and the staff had had particularly up-hill work to satisfy purchasers of plant to such an extent as to obtain orders and payment. The position had been not without value, for there was no doubt that right through the industrial community there had been for some years with the majority of them too much inclination in dealing with their work to say "that is near enough," instead of aiming at the very highest production possible. For the year 1921 they were able, through cessation of buying and a continuance of manufacturing, to put extraordinary results before them. For the year under review, and also during the present 12 months, they were engaged in slowly building up their order sheet, and in turn placing orders with those who furnished them with supplies of materials. The scarcity of orders caused a reduction of prices to an unprofitable level, and buyers had been able to purchase at unduly low figures. So much was that the case that for the half-year ending June 30th of this year they would probably see the low-water mark of profit making; after that period it was highly probable that the increased demand would have operated to make possible some return on the capital involved in manufacturing, though he wished to warn shareholders that the lifting of prices to a reasonable level followed slowly on the increasing demand, and he, for one, would be well satisfied if they were able to maintain the financial strength of the company at to-day's level throughout this year. It might interest shareholders to know that in the opinion of many good judges of such matters the electrical manufacturing industry of England was before the war perilously near being at the mercy of foreign interests. By hearty co-operation and strenuous endeavour that condition of affairs had been greatly remedied. It was a matter for regret that there was occasionally still evidence of thoughtless or little-minded purchasers of electrical plant desiring to break up the co-operative spirit which alone brought our enemies to a standstill. Fortunately they had such strong co-operative efforts as those of the British Electrical Development Association, the Incorporated Municipal Electrical Association, those of electrical power supply companies and various manufacturers' associations, as evidence of the determination of the whole industry to get even more thoroughly organised than at present. Even as those of them who were responsible for the management of this company pursued the policy of co-operation with their friends in various sections of the industry, so could a numerous body of shareholders, such as those of that company, help themselves and the company.

The speaker went on to show how the 3,000 shareholders of the company could co-operate in extending the "Tricity" electric heating and cooking business.

Mr. T. Rowe seconded the motion, which was adopted after a short discussion.

Indo-European Telegraph Co., Ltd.

In presenting the report and accounts at the annual meeting on April 25th, the chairman (Mr. J. Herbert Tritton) referred with regret to the deaths of Messrs. Stratford-Andrews and Holland, two of the directors; their positions had been filled by the appointment of Messrs. Axel Berg and Claude H. Tritton.

The company had unwillingly been involved in a dispute which had had the effect of depriving it of its concession from the German Government. In spite of the directors' untiring efforts a satisfactory solution of the difficulty had not yet been found. Settlement might come within a few days, or it might be delayed for months. When it came it would permit the re-opening of the company's through route, and enable them to handle international traffic exchanged with the United Kingdom, in addition to the similar traffic with the Continent already being carried. The satisfactory result to the shareholders was due to the generous assistance of the company's partners in the Cis-Indian Joint Purse, but the latter had intimated that this assistance could not be continued indefinitely. Therefore, unless the difficulties were removed, the shareholders could not expect the dividend to remain at its present level. The shareholders should bear in mind that although the company's capital resources were probably still adequate, they had been reduced by £350,000 as a result of the war.

By strenuous efforts one wire had been restored between Warsaw and Teheran, and had been earning revenue from Continental International traffic. The portion of the route traversing Poland had had to be entirely rebuilt with three wires for a distance of 370 miles, and repaired for a further distance of 180 miles. The work had been harder on account of the winter and the difficulty of obtaining supplies. Both the Polish and Soviet Governments had rendered great assistance, and the result was also due in a large measure to the co-operation of the company's Moscow, Warsaw, Odessa, Teheran and London offices. The work in Poland and Russia was not yet complete, certain sections having had to be bridged by the loan of Government wires, but it would be completed this summer. The stations in Poland, the Ukraine, and the Caucasus had had to be re-staffed and in many cases re-equipped. The work on all sections had involved an expenditure of £170,000; this would probably reach £200,000. Much of this was due to the accumulation of repairs during eight years owing to the war.

The report and accounts were adopted.

Gateshead and District Tramways Co.

The directors' report for 1922 shows a total revenue of £124,977. After the deduction of all expenses chargeable to revenue, including £13,000 for renewals, there remained a balance of £23,230, which, added to a balance of £22,407 brought forward, gives an available total of £45,637. It is proposed to allocate this as follows: Special reserve, £5,000; sinking fund for mortgage redemption, £3,317; dividend on 6 per cent. preference shares, £756; dividend on 5 per cent. preference shares, £6,000; dividend of 10 per cent. on ordinary shares, £13,589; carried forward; £16,975. During the year 150 ordinary shares of £10 each were issued, and the redemption of the mortgages, amounting to £42,000, was completed. The doubling of a portion of the track was completed and a new junction and terminal tramway were also opened for traffic.

Electric Supply Corporation, Ltd.

The annual meeting was held on April 30th. The chairman (Mr. J. G. B. Stone), in presenting the report and accounts, said that 1922 marked the beginning of a period of greater prosperity. The profit in 1920 was £9,500; in 1921, £19,500; and in 1922, £29,500. During the year the connections were increased by the equivalent of 18,121 33-watt lamps, and with the building of dwelling houses becoming more active, a growing load could be expected. Working expenses had fallen by over £13,000, and the revenue had increased. Dumbarton, however, owing to the depressed state of the shipbuilding industry, had only contributed £22,242, as against £32,257. The income derived from investments showed a satisfactory increase from £4,636 to £6,383. The share capital now stood at £150,000, a balance of £100,000 having been written off; the debenture stock remained the same.

The long negotiations with regard to the Exmouth Order had come to a satisfactory conclusion; the Order approving an increase of charges now awaited formal sanction. It was hoped that the Hitchin Order would soon receive approval. The Dumbarton Tramways Co. had not paid a dividend, but

the receipts from the Hendon & Dawlish companies were maintained. It was proposed to transfer £10,000 to a depreciation fund.

Mr. A. A. Campbell Swinton, in seconding the motion for the adoption of the report, said that they would no doubt be assailed with demands for a reduction in the price of energy, but consumers must remember that the improvement in the electric lamp made lighting much cheaper if the price of the energy appeared more.

Cork Electric Tramways and Lighting Co., Ltd.

The directors' report for 1922 states that the revenue was £133,661, and the expenditure £92,561, leaving £41,100. From this were deducted: Interest account, £209; debenture interest, £4,600; transfer to reserve for depreciation and renewals, £15,000; and transfer to reserve for contingencies, £2,500; leaving £18,791, to which is added £2,780 brought forward, making £21,591. This is to be disposed of as follows:— Dividends already paid, £12,327; dividend on preference shares for the year ended December 31st, 1922, £6,164; carried forward, £3,100. The revenue from the tramways showed an increase of £10,021, and that from lighting and power a decrease of £10,204. Profits on supply sales, &c., showed a decrease of £1,337. While there was an increase in distribution costs, tramway maintenance and operation costs, and management and other expenses, the generating costs were reduced by £16,441. The capital expenditure during the year amounted to £5,378, being absorbed chiefly by new plant and cables to meet the increasing demand for electricity, and the completion of the new plant at the Queenstown station.

The number of passengers carried by the tramways increased from 4,776,124 to 5,247,353 and the car-mileage from 516,536 to 715,807. The energy sold increased from 4,323,160 kWh to 5,234,645 kWh, and the number of consumers from 3,587 to 3,779.

Meeting: London, to-day (Friday).

Direct United States Cable Co., Ltd.

The directors' report for 1922, to be presented at the annual meeting on May 9th, records a total income of £41,884, which added to a balance of £3,916, brought forward, gives an available total of £45,780. After providing for income tax, Corporation profits tax, directors' fees, and administration expenses, a balance of £27,903 remained, out of which an interim dividend at the rate of 4 per cent. has been paid for the six months ended September 30th last. In view of the imminent winding-up of the company no further distribution is to be made. The directors have given careful consideration to suggestions that the company should be continued as an investment company, and have come to the decision that it is in the best interests of the shareholders that the assets should be realised and distributed. Accordingly, the following resolution is to be submitted at the annual meeting:—" That the company be wound up voluntarily and that William Miles, of 240, Winchester House (aforesaid) be and he is hereby appointed liquidator for the purpose of such winding up." The proceedings will be confirmed at an extra-ordinary meeting on May 25th.

British L. M. Ericsson Manufacturing Co., Ltd.

In moving the adoption of the report and accounts at the annual meeting on April 30th, Mr. W. M. Crowe (chairman) said that in view of the depression which was still prevalent the results for 1922 could not be considered unsatisfactory. The scarcity of orders, the engineers' lock-out, and the derangement of the foreign exchanges, had all rendered business difficult, but the important contracts secured from the Colonies had kept the works going. The question of Empire trade was of the first importance, and he welcomed the projected conference between the Home and Dominion Governments on the subject. The burdens of taxation and railway rates were still far too heavy. The 6d. off the income tax and the reduction of the corporation profits tax afforded some relief, but it was doubtful if these would give the stimulus to trade which was so necessary at the present time. While the net profit was £10,681, the income tax (based on the three-years' average) was £14,298. The recent reductions in railway rates were inadequate, and must be followed by further decreases before any benefit could be felt. Above all, stability of conditions—labour, exchanges, and supply and demand—was absolutely necessary.

They were concerned with the reduction of orders from the Post Office. While Government economy was to be welcomed, when this was carried out to such an extent in a revenue-producing department it was short-sighted and false economy. The springing up of " broadcasting " had resulted in business for the company. It was making crystal and valve sets and a successful loud speaker, and its British-made head-'phones were unrivalled. Early in the present year an office had been opened in Calcutta. This should be of great assistance in the obtaining of Indian telephone business.

Turning to the accounts, the chairman said that their past policy had been to deal liberally in the matter of depreciation. The result was that 45 per cent. of the plant stood in the books at no value. Owing to circumstances the past year's provision had not been so high, but it had been decided to transfer an amount of £15,000, previously set apart for contingencies, to make up the shortage. During the past 20 years they had spent £350,000 on plant, machinery, buildings, &c. The depreciation on these items had totalled £218,000 (over 62 per cent.), and in addition £175,000 had been spent out of revenue upon maintenance. With regard to stocks, during 1922 they had liquidated most of the items which had fallen in price, and the remainder had been adequately depreciated. They had been enabled to pay an 8 per cent. dividend on the ordinary shares by the balance brought in from the last accounts; in the good years of the past, however, the amount paid had been on a very conservative scale.

The report and accounts were adopted, and subsequently resolutions were put to the meeting regarding the directors' remuneration and debenture interest. These were also adopted.

Dublin and Lucan Electric Railway Co.

Mr. J. W. Hill presided at the annual meeting, which was held recently. He said that the accounts showed a net loss of £2,627. The directors could not recommend the payment of the usual half-yearly dividend on the cumulative preference shares; this would leave the dividend on these shares seven years in arrear. Both the mileage run and the number of passengers carried showed an increase, and while the receipts showed a slight increase, expenses had been considerably reduced. The passenger service had been reduced and the Sunday and goods services suspended. The chairman spoke with approval of the projected harnessing of the Liffey, which, he said, would be of great benefit to the company. There was every probability that the scheme would soon be put into effect. He had no hesitation in stating that, as the pioneers of the present proposals, their company would receive very great benefits from the proposed scheme, which they evolved many years ago. At the same time he wished to say that had it not been for the unsettled conditions that then came upon the country the Liffey would have been supplying the necessary power for all the requirements of their undertaking before now, at a cost that would have altered the entire future prospects of the company.

Argentine Tramways and Power Co.

The directors' report for the year ended September 30th, 1922, states that while in some directions improvements in trade were noticeable in the Argentine during the year, any general revival was retarded by the unfavourable condition of the cattle-breeding industry and, during the whole year, the rate of exchange was against Argentina. There was, however, some improvement in business and increased movement in the port of Santa Fé. The gross receipts of both the light and power and the tramways departments showed a satisfactory increase, which was reflected in the net receipts from operation. The net revenue from operation, after providing for renewals, amounted to £37,697. Adding interest earned and transfer fees received during the year, the revenue account shows a total of £38,371, from which there falls to be deducted provision for loss in exchange amounting to £4,249. After charging interest and sinking fund on the debenture stock, the expenses of the scheme of reorganisation of the capital of the company and London expenses, there remains a balance of £18,836, making, with £245 brought forward, £19,082. After meeting the 7 per cent. preference dividend for the year, £832 remains to be carried forward.

Craigpark Electric Cable Co., Ltd.

The accounts for the year ended March 31st, 1923, show a net profit of £10,842 (after making provision for Corporation Tax), which, with the balance of £1,797 brought forward, makes £12,640. It is proposed to place to depreciation of buildings and machinery £1,000; to reserve account, £2,000; to pay the 6 per cent. preference dividend and a dividend of 12½ per cent. per annum on the ordinary shares, leaving to carry forward, subject to payment of directors' fees for the past year, £2,102. Stocks have been carefully gone over by the managing director and are certified by him as being correct. The general depression in trade throughout the year has had its effect on the operations of the company and the directors consider the results of the year's trading satisfactory under the circumstances.

Calcutta Electric Supply Corporation, Ltd.

Lord Meston, K.C.S.I. (chairman) presided at the annual meeting on April 30th. In presenting the report and accounts (*vide* ELEC. REV., April 27th, p. 666) he said that the issued share capital had risen from £1,405,000 to £1,655,000; debenture loans from £494,500 to £759,100; and the block account from £2,212,354 to £2,822,824. Investments and cash had fallen from £554,710 to £487,326. Revenue had increased but, at the same time, owing to dearer fuel and higher wages, production costs had also risen. The gross profits were greater, but prior charges had increased. It was considered prudent to set aside a very full allowance for depreciation and renewals. The net result was, therefore, about the same as that of the previous year and the same dividend—10 per cent., plus 1 per cent. bonus—on the ordinary shares was recommended. The year had been one of transition and yet of continued progress. During the years which followed the war the difficulty of obtaining new plant had forced them to move more slowly than they wished, and the demands of prospective consumers accumulated. These demands they were now

endeavouring to clear off by expediting the installation of the new plant which could deal with them. During the year they had only been able to install a 6,000-kW generating set and a 30,000-lb. boiler, but by the end of the year they had under order two 15,000-kW sets, which would soon be delivered. The also had six new 60,000-lb. boilers under construction, in addition to new cables and other accessories.

Referring to the high production costs, the chairman pointed out that the price of fuel in 1922 averaged 23s. 7½d. per ton, as compared with 8s. 5d. in 1914. There had been labour unrest in Calcutta, but the company had experienced only a small sectional strike. They had, unfortunately, had to increase the price of energy, but even with the surcharge the rates were still below the 1914 level. In order to keep in close touch with the public a representative consultative committee had been formed.

The future prospect gave them confidence. They had succeeded in avoiding any serious loss on account of the rupee exchange and the question seemed in a fair way to settle itself.

The report and accounts were adopted.

French Companies.

Société Pyrénéenne d'Energie Electrique.—The accounts of this company for the year 1922 show distributable profits of about 1,244,000 fr., being about 200,000 fr. in excess of 1921. A dividend of 8 per cent. was declared, equal to 40 fr., against 7 per cent. and 35 fr. in 1921. This means the receipt of 31.25 fr. instead of 16.50 fr., net. Capital sinking fund payments were 2,660,000 fr., against only 1,615,000 fr. in 1921.

The dividend distributed by the *Société Bitterroise de Force et Lumière* was 8 per cent., or 40 fr., as compared with 7 per cent. and 35 fr. in 1921.

Société Versaillaise de Tramways Electriques et de Distribution d'Energie.—An ordinary meeting of this company has approved the accounts for 1922 showing net profits of 1,037,180 fr., and, after deduction of municipal dues, taxes, and octrois, net receipts of 1,319,558 fr. were shown, being an increase on the preceding year of 282,828 fr. A new tramways sub-station at 50 periods has been substituted for the old one, and since July the Versailles network has been supplied from the new Gennevilliers station. A gross dividend of 27.50 fr. on the priority shares, 25 fr. on the ordinary, 18.15 fr. on the new shares, and 12.50 fr. on the shares *de jouissance* was sanctioned.

Compagnie d'Energie Electrique.—The receipts of this company for 1922 totalled 16,898,538 fr., of which 10,351,431 fr. stood for actual working expenses. After allowing for a variety of charges the net profits showed 1,677,421 fr., from which a dividend of 7 per cent., or 35 fr. was declared.

Société Algérienne d'Eclairage et de Force.—The gross profits of the year 1922 amounted to 9,643,569 fr., against 10,899,445 fr. in 1921. Working expenses were, however, 5,710,026 fr., against 7,675,418 fr. in 1921. After various disbursements the net profit was 1,430,732 fr., against 918,919 fr. in 1921. A dividend of 10 per cent., or 25 fr., against 20 fr., was announced.

Belgian Companies.

The *Société Générale Belge d'Entreprises Electriques* proposes to pay a dividend at the rate of 40 fr. per share out of net profits of 2,452,000 fr. in 1922, this result comparing with 35 fr. and 2,104,000 fr. respectively in 1921.

The *Compagnie Générale de Railways et d'Electricité* of Brussels has decided to distribute a rate of 30 fr. per share for 1922. At the same time the share capital is to be increased by 10,000,000 fr. to 60,000,000 fr. by the issue of 20,000 new shares.

The report of the *Société Belge pour la Fabrication des Cables et Fils Electriques* states that net profits amounting to 750,000 fr. were earned in 1922, permitting of the payment of a dividend on the ordinary capital at the rate of 36.10 fr. per share. During the year additional machinery was purchased for the extension of the business, including a lead press for the production of lead-covered cables. It is mentioned that the company holds the majority of the shares in the French Société des Cables et Tubes du Nord, whose works was brought into operation at the beginning of last September.

The report of the *Ateliers de Constructions Electriques de Charleroi* states that, notwithstanding that the unfavourable economic factors continued to operate during the greater part of 1922, it was possible to maintain normal activity throughout the year. A material change, however, took place at the end of the year, and sale prices, which in certain cases had fallen to the level of the cost of production, then began to improve. The new works at Ruysbroeck, which was completely equipped and organised from the end of 1921, had fulfilled the manufacturing programme allotted to it. Regular progress took place in the sales of small alternating and continuous-current motors, and it was expected that the activity of this department would further develop in the new financial year; for the rest small and medium-sized motors were among the company's chief export manufactures. The efforts made to increase the foreign markets had begun to bear fruit, and the agencies in England, Brazil, Holland and in Luxemburg had realised a very encouraging turnover last year. Included in the production in 1922 were many winding engines of from 300 to 2,000 h.p., turbo-alternators of 10 to 15,000 kW, and centrifugal pumps of 500 h.p. As a consequence of the working results obtained during two years of a severe depression, it was possible for the directors to look to the future with confidence. The net profits in 1922 amounted to 5,314,000 fr., as contrasted with 5,767,000 fr. in the preceding year, and a dividend at the rate of 15 fr. per share (6 per cent.) has been declared, as against 17.50 fr. in 1921.

Birmingham District Power and Traction Co., Ltd.

Speaking at the annual meeting on April 27th, Mr. C. Shirreff Hilton (chairman) said that the balance sheet showed a marked improvement in the company's financial position. The bank overdraft had been paid off; available cash resources had been considerably increased, and a further £10,321 of first debenture stock had been redeemed, making the total redemption £122,488. The expenses had decreased to a greater extent than the revenue. It had been considered unwise to pay the full dividend of 6 per cent. on those ordinary shares which did not rank for dividend until January 1st, 1922; instead, the carry-forward had been increased. The year was one of slow recuperation, but the improvement in the business of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. (of which they held the greater part of the ordinary shares) led them to believe that an industrial revival was commencing.

Prospectus.—*The Andhra Valley Power Supply Co., Ltd., Bombay.*—On Monday last there was offered for sale £1,000,000 7½ per cent. ten year secured Sterling Notes, in this company, at 98 per cent. The issue was at once over-applied for. We quote the following informative particulars from a statement by the company's attorney, appearing in the prospectus:—

The company was formed in 1916, under the auspices of Tata Sons, Ltd., for the purpose of meeting as far as possible the demand existing for electric power in Bombay over and above the capacity of the Tata Hydro Electric Power Supply Co., Ltd., formed in 1911, and acquired from that company a licence granted to it by the Government of Bombay under the Indian Electricity Act, 1910, for the supply of electrical energy in the City of Bombay, the municipal areas of Kurla, Bandra, Matheran, Kalyan, Thana, and Ghatkoper and local areas near the railway stations of Andheri, Santa Cruz, and Vila-Parle on the Bombay, Baroda, and Central India Railway. The demand for electric power in Bombay has largely increased since the formation of this company, and a third power company has been formed under the same auspices. When this new company's works are completed there will be three companies all under the agency of Tata Sons, Ltd., capable of producing 685,000,000 kWh per annum.

The works of the company are practically completed. The greater part is in operation and the whole is expected to be in full operation by June next. The power house is situate in the Andhra Valley, about 56 miles from Bombay, and contains a generating plant comprising six generators and transformers capable of supplying in Bombay an average load of 50,000 h.p. The head of water is provided by a lake formed by the construction of a masonry dam 190 ft. high, 148 ft. wide at the base and 15 ft. at the top, and 1,850 ft. long. The lake is nine miles long, with a storage capacity of 14,484 million cubic feet, and covers an area of 12.5 square miles, the water being conveyed to the power house by a tunnel and pipe lines. There are transmitting lines consisting of a double line of three conductors carried on steel trestle towers transmitting the current from the power house to Bombay, a receiving and transforming station in Bombay, and transmission cables to consumers' works with the necessary transforming plant. The company's power house and the power house of the Tata Hydro-Electric Supply Co. and their respective receiving stations in Bombay are inter-connected by tie-lines. There are also nine miles of broad-gauge railway connecting the power house with the G.I.P. Railway, and a large repairing workshop in Bombay, a full equipment of spare parts of machinery and apparatus, also the necessary transport equipment of motors, cars, and lorries.

The total capital cost of the undertaking is estimated at approximately £3,400,000. This has been provided by the share capital and debentures issued in India (producing upwards of £2,000,000) and by unsecured temporary loans. The notes are being issued for the purpose of funding these temporary loans, with the exception of a sum of about £333,000, which has been provided by Tata Sons, Ltd., and will be gradually discharged out of profits, and in the meantime will rank behind the debentures upon which the notes will be secured.

The notes will be secured by a trust deed in favour of the Law Debenture Corporation, Ltd., as trustee.

The company has been supplying power in Bombay since September last, and already has 10-year contracts with consumers in Bombay comprising 35 cotton and textile mills, operating an aggregate of about 1,500,000 spindles and about 33,000 looms, a flour mill and an ice factory, which it is estimated will require about 100 million kWh per annum at .725 anna per unit.

In addition to the above the Bombay Electric Supply and Tramways Co. which has a rapidly increasing demand, has entered into a 15-year contract, with option to extend it, with the three hydro-electric companies (of which this company is one) under the agency of Messrs. Tata Sons, Ltd., for the supply of current, and it is computed that this company's proportion of the supply will be 60 million kWh per annum at about .6 anna per kWh. The tramways company are day and night consumers.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

South London Electric Supply Corporation.—30,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 260,001 to 290,000, and 260,000 ordinary shares of £1 each, fully paid, Nos. 1 to 260,000.

North Metropolitan Electric Power Supply Co.—£350,000 5½ per cent. debenture stock, partly and fully paid.

The undermentioned have been ordered to be officially quoted:—

Bournemouth and Poole Electricity Supply.—150,000 ordinary shares of £1 each, fully paid, Nos. 250,001 to 400,000; 75,000 4½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 75,000; and 175,000 6 per cent. cumulative second preference shares of £1 each, fully paid, Nos. 75,001 to 250,000.

Brompton and Kensington Electricity Supply.—290,310 ordinary shares of £1 each, fully paid, Nos. 1 to 290,310.

Madras Electric Supply.—£200,000 7 per cent. second (registered) debentures of £100 each, Nos. 1 to 2,000.

South London Electric Supply.—260,000 ordinary shares of £1 each, fully paid, Nos. 1 to 260,000.

City of Santos Improvements Co., Ltd.—Speaking at the annual meeting on April 25th, Mr. N. B. Dickson, M.Inst.C.E. (chairman), said that the City of Santos continued to improve. The company's gas department had shown a profit for the first time; the water supply had increased, and the tramways had carried an additional 2¼ million passengers. The consumption of electricity showed a steady increase.

Salisbury Electric Light & Supply Co., Ltd.—The report for 1922 shows a balance on the year's working, after paying debenture interest and providing for income tax and depreciation, of £6,733. The dividend is 10 per cent. for the year; £3,000 is put to reserve; and £233 is to be carried forward. New premises for offices and showrooms have been secured.

Companies to be Struck off the Register.—The following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

British Electrical Winders, Ltd.
Accumulator Trust, Ltd.
Printing Telegraph Accessories, Ltd.

Electric Supply Corporation, Ltd.—Dividend of 5 per cent., less income tax, on the ordinary shares for the half-year, making 8 per cent. for the year; £10,000 to depreciation fund; and £3,363 carried forward.

North Metropolitan Electric Power Supply Co.—In connection with the issue of £350,000 5½ per cent. debenture stock, the total amount applied for was over £3,400,000.

City of Buenos Aires Tramways Co., Ltd.—Dividend of 1s. 3d. per share, less tax, being at the rate of 5 per cent. per annum, for the three months ended March 31st.

Vickers, Ltd.—Dividend for 1922 at the rate of 5 per cent. per annum, less tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The plethora of money and the constantly rising prices of investment securities have led to a discussion amongst economists as to whether the present is an opportune moment for the Government to introduce the big funding scheme which it is known to have in contemplation for the purpose of unifying the National Debt, and of putting British Government loans on a basis more permanent than that which has obtained since the outbreak of war. These discussions have reached the public eye, and may have something to do with a slight weakening of prices amongst gilt-edged stocks. The argument runs, of course, that if the Government considers this to be a good time for setting up a conversion scheme, the inference is that the official mind regards existing conditions as likely to be about as easy as can be expected in the money market for some years to come.

Consequently, a few people are beginning to sell their gilt-edged stock, in case it may prove that trade requirements and industrial needs are about to enter into active competition with Stock Exchange securities, to the natural disadvantage of the latter. The tendency of prices to decline is very slight indeed at present, and some of the best authorities, and a large proportion of the Stock Exchange, look for the continuance of cheap money. They urge that there is nothing to be gained, from the Government's point of view, by proceeding with any colossal unification plan, contending that the outlook for cheap money is bounded by no immediate considerations.

These factors operate, naturally, in the markets for stocks and shares peculiarly associated with investment, and apart from speculative possibilities. In the electricity sections they have so far had no effect, nor are they likely to exert any unfavourable influence over quotations for a long time to come. Amongst the Electricity Supply ordinary shares, further rises have taken place this week in Chelseas at 8¼, South Londons at 7, and Westminsters at 9½. St. James's hardened to 10¼. Bournemouth and Poole ordinary are now quoted as £1 shares instead of in their old shape of £10 shares, and the price of 29s. in the former is equal to 14½ for the latter. The high prices to which electricity supply shares have attained are responsible for a certain amount of stock being available, although the area of supply continues strictly limited in the greater number of cases.

Amongst the manufacturing issues, Edison Swan 5 per cent. debenture stock has risen 3 to 64, and Metropolitan-Vickers preference strengthened to 2 9/16. English Electrics at 18s. and the preference at £1 are both a little better. General Electrics are a shade easier at 21s. 3d. Of the companies more particularly connected with cables, Callender's hardened to 2⅜, emphasising the comparative cheapness of the company's 7½ per cent. "B" preference, of which there are still a few hundred to be obtained on the basis of 26s. Babcock and Wilcox, in the engineering group, put on another 1/16 to 4 9/16, and, as the shares will be ex dividend this week, they present a fairly cheap appearance. The price will be halved, of course, after the shareholders have agreed to the distribution of the bonus shares of one new for every one old at present held. To those investors who can hold them for the future, 2¼ ex dividend and rights would appear to be a reasonable price to expect in the future. The iron and steel shares are firm, and a good deal of gossip concerns itself with various companies which are said to be contemplating amalgamations, absorptions and working agreements.

The Eastern group of cable stocks is better, rises having occurred in Eastern Extensions and Eastern Telegraph ordinary. Anglo-American Telegraphs of both classes are harder. Marconis fell back to 2¾—a disappointing market. As soon as any little improvement occurs and the price improves, the advance is promptly checked by the offering of considerable quantities of shares, the source of which it is difficult to trace. Nothing further has been heard in respect of the Government's promise, made in the middle of March, to give the Marconi company licences, for the erection of new stations, that will enable it to proceed with its comprehensive programme of wireless development. The Canadian Marconi report is expected to be issued this month, but, in spite of the optimistic anticipations as to its contents, the price of the shares remains dull at 9s. 9d.

Central London Railway assented ordinary stock is a point higher at 73; Metropolitans hardened to 69; Districts gave way to 54¼. There has been substantial buying of Underground Electric income bonds, raising the price to 97½, the company's shares remaining unaltered. Foreign traction issues are somewhat uninteresting. The recovery in Anglo-Argentine Tramways continues to make progress, and Mexicans are inclined to harden, although in the case of Mexican Light & Power common and preferred stocks, small falls occurred. British Columbia stocks are better, and, in the home group, British Electric Traction preferences have achieved par. Several of the Indian traction stocks are better.

Whitehall Electric debenture has risen to 94¾, the preference shares remaining steady at 19s. 6d. New issues continue to be taken with a good deal of avidity, though the public are displaying more discrimination than usual. While there is a ready demand for stocks and shares offering a fair run for the money, as the Stock Exchange says, investors are not rushing blindly into some of the less tempting propositions that have been put before them during the past few weeks. Which is likely to prove all to the good of those investors.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price April 30, 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	36/6	—	£6 11 4
Charing Cross Ordinary ...	5	9	14	10½	—	6 13 4
do. do. do. 4½ Pref.	5	4½	4½	4½	—	5 6 0
Chelsea	5	6	10	8½	+ ¼	5 17 8
City of London	1	14	15	2⅞	—	6 9 10
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 4 4
County of London	1	8	10	2	—	5 0 0
do. do. 6 % Pref. ...	1	6	6	1⅛	—	5 4 4
Edmundson's Ordinary	3	Nil	—	2¾	—	Nil
do. 6 % Pref. ...	5	12/-	—	4¾	—	6 13 4
Kensington Ordinary	5	10	12	8¾	—	6 13 4
London Electric	3	4	10	4¾	—	6 3 1
do. do. 6 % Pref. ...	5	6	6	5⅛	—	5 17 1
Metropolitan	1	7	8½	28/6	—	5 19 4
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	7/8	—	2 17 2
do. 5 % Pref. ...	1	5	5	15/9	—	6 7 0
do. 7 % Pref. ...	1	7	7	23/6	—	5 19 2
Notting Hill, 6 per cent. Pref....	10	6	6	9¾	—	6 9 9
North Met. Elec., 6 % Pref. ...	1	6	6	1 1/16xd	—	5 13 0
Urban Ordinary	3	Nil	—	1½	+ ⅛	Nil
do. 5 % Pref. ...	5	2½	—	4¾	—	5 5 3
St. James' and Pall Mall ...	5	12	14½	10⅝	+ ¼	6 13 4
South London	4	7	10	7	+ ¼	5 14 3
South Metropolitan Pref. ...	1	7	7	1 3/16	—	5 14 10
Westminster Ordinary	5	10	12	9½	+ ⅛	6 6 4
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/6	—	7 13 10

Home Rails.

Central London Ord. Assented	Stock	4	4	73	+1	5 9 7
Metropolitan	,,	2½	3½	69	+ ½	5 1 5
do. District	,,	1	3	54½	− ½	5 10 2
Underground Electric Ordinary	10	Nil	Nil	3¼	—	Nil
do. do. "A" ...	1	Nil	Nil	9/6	—	Nil
do. do. Income	Stock	4	5	97½	+ 1	*5 2 9

Telegraphs and Telephones.

		Dividend. 1920.	Dividend. 1921.			
Anglo-Am. Tel. Pref.	Stock	6	6	104	+ ½	5 15 5
do. Def.	,,	1½	34/6	22⅝	+ ¼	6 13 4
Chile Telephone	5	6	6	6¼	+ ¼	4 16 0
Cuba Sub. Ord.	10	7	7	8	—	8 15 0
Eastern Extension	10	10	10	18⅞	+ ½	6 6 8
Eastern Tel. Ord....	Stock	10	10	187½	+ 1	5 6 8
Globe Tel. and T. Ord. ...	10	10	10	18¾	—	5 6 0
do. do. Pref....	10	6	6	11½	—	5 4 4
Great Northern Tel.	10	21	22	30	−	7 6 8
Indo-European	25	10	10	37½	—	6 13 4
Marconi	1	25	15	2⅝	− ¼	6 6 4
Oriental Telephone Ord. ...	1	12	12	2 1/16	—	*4 5 5
United R. Plate Tel.	5	8	8	7½	—	*5 6 8
West India and Panama ...	10	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	10	18⅝	−	*5 7 5

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	3½	—	† 17 2
do. do. 2nd Pref.	5	Nil	5½	3 1/16	+ 1/16	9 1 6
do. do. 5 % Deb.	Stock	5	5	81½	+ ½	6 2 5
British Electric Traction Ord.	,,	4½	—	74½	—	6 0 10
do. do. 6 % Pref.	,,	6	6	100	+1	6 0 0
Brazil Tractions...	100	Nil	Nil	54	—	7 8 2
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	87½	+1	5 15 7
do. do. Preferred	,,	5	93/-	78½	+1	*6 0 0
do. do. Deferred	,,	3	124/-	88½	—	*6 19 9
do. do. Deb. ...	,,	4½	4½	80	—	5 6 3
Lond. & Sub. Trac. 5 % Pref.	1	2½	3½	11/-	—	9 2 0
London United Tram. Deb. ...	Stock	4	4	64½	—	6 4 0
Mexico Tram. 5 % Bonds ...	—	Nil	Nil	81½	—	6 2 8
do. 6 % Bonds ...	—	Nil	Nil	61½	—	Nil
Mexican Light Common ...	100	Nil	Nil	21½	−1	Nil
do. Pref.	100	Nil	Nil	80½	−2	Nil
do. 1st Bonds ...	—	Nil	5	70½	+1	7 1 10

Manufacturing Companies.

Babcock & Wilcox	1	15	20	4 1/16	+ 1/16	4 7 9
British Aluminium Ord. ...	1	10	5	21/9	+1/9	4 12 0
British Insulated Ord.	1	15	15	2 1/16	+ 3/16	6 3 0
Callenders...	1	15	15	2⅜	+ 1/16	6 6 4
do. 6½ Pref.	1	6½	6½	23/-	+6d.	5 13 1
Crompton Ord.	1	10	5	¾	—	6 13 4
Edison-Swan	1	10	Nil	4/3	—	Nil
do. do. 5 % Deb.	Stock	5	5	64	+3	7 16 4
Electric Construction	1	10	10	28/9	—	6 19 2
English Electric	1	8	5	18/-	+3d.	5 11 1
do. do. Pref.	1	6	6	1	+6d.	6 0 0
Gen. Elec. Pref.	1	6½	6½	23/3	+6d.	5 11 10
do. Ord.	1	10	5	21/3	−6d.	4 14 0
Henley	1	15	15	2 1/16	—	6 3 0
do. 4½ Pref.	5	4½	4½	4¾	—	5 2 10
India-Rubber	1	10	—	⅜	—	—
Met.-Vickers Pref.	2	8	8	2 1/16	+ 1/16	6 4 9
Siemens Ord.	1	10	10	21/3	—	Nil
Telegraph Con.	12	20	20	25½	—	*4 16 0

†Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price May 2nd.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	6¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£51	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£28	...
a Copper Sulphate ... ... ,,	£26 15s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4¼d.	...
a ,, Perchlorate ... ... ,,	5d.	...
a Shellac ... ... per cwt.	£17	£1 dec.
a Sulphur, Sublimed Flowers ... ,,	£9	...
a ,, Roll ... ... ,,	£8 10s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 10s.	...
a Sodium Bichromate, casks ... per lb.	4¼d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£110 to £115	...
b ,, Wire ,, ... per lb.	1/9 to 2/6	...
b ,, Sheet ,, ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£200	£2 inc.
Grade II ... ... ,, ,,	£141	£1 dec.
Grade III... ... ... ,, ,,	£77	£2 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	10½d.	½d. dec.
c ,, Tubes (solid drawn) ... ,,	1/1 to 1/1½	...
c ,, Wire, basis ... ... ,,	10½d.	½d. dec.
c Copper Tubes (solid drawn) ... ,,	1/2½d.	...
c ,, Bars (best selected) ... per ton	£106	...
c ,, Sheet ... ... ,,	£106	...
c ,, Rod ... ... ,,	£106	...
d ,, (Electrolytic) Bars ... ,,	£79 15s.	85/- dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£89 15s.	85/- dec.
d ,, ,, H.C. Wire per lb.	11 1/16d.	½d. dec.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	3/-	...
n German Silver Wire ... ... ,,	2/3	3d. dec.
h Gutta-percha, fine ... ... ,,	5/6	...
h India-rubber, Para fine ... ... ,,	1/2½	½d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	92s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£27	15/- dec.
g Mercury ... ... per bot.	£10 to £10 5s.	5/- dec.
e Mica (in original cases) small ... per lb.	3d. to3/-	...
e ,, ,, medium... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/2	...
p ,, drawn bars and rods ,,	1/4½	½d. inc.
p ,, rolled strip & sheet ,,	1/3½	...
p ,, wire ... ... ,,	1/4½	½d. dec.
o Platinum ... ... per oz.	£23	...
d Silicium Bronze Wire ... ... per lb.	1/2	...
r Steel, Magnet, in bars ... ... ,,	10d.	...
n Tin, Block (English) ... ... per ton	£215 to £215 10s.	£5 10s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/-	5d. dec.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Holling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

U.S.A. Electric Vehicle Market.—Manufacturers of electric trucks report that business continues to improve.

A tea firm in Chicago which operates more than 1,000 gasolene-driven trucks in various western cities recently placed orders for 100 electric trucks; if the latter prove satisfactory, the company will purchase an additional 900 vehicles, which will be substituted for the motor trucks now in use. An English shipping company has bought six industrial trucks for use on its piers. The American Express Co. has purchased 25 electric trucks for use in San Antonia, Texas, to replace 100 horse-driven trucks, bringing the total number of electric trucks in use by this company to approximately 1,500. Many smaller orders have been received during the past few weeks.

The New York manager of an electric truck manufacturing company said that his company's output in March was the largest for any month in the firm's history, and that the number of orders on hand on April 1st also established a new high record; the concern is booked up to capacity for the next three months.

One truck manufacturer has appropriated 100,000 dollars for advertising during the next twelve months; two other firms propose to spend this year about 50,000 dollars each for advertising. Exports are more active; one company shipped 26 trucks to Cuba during the past few weeks; another concern sold four trucks for use in Rio de Janeiro. Five industrial trucks were dispatched to Manila; and Australia is in the market for electric trucks. The first session of the new Electric Vehicle School will be held in New York City from May 15th to 26th. The programme covers every phase of the industry.—*Reuter's Trade Service* (New York).

UNDERGROUND CABLES AT 150,000 VOLTS.

By MAJOR A. M. TAYLOR, M.I.E.E., Mem.Am.I.E.E.

(*Concluded from page* 649.)

Single-core versus Intersheath.

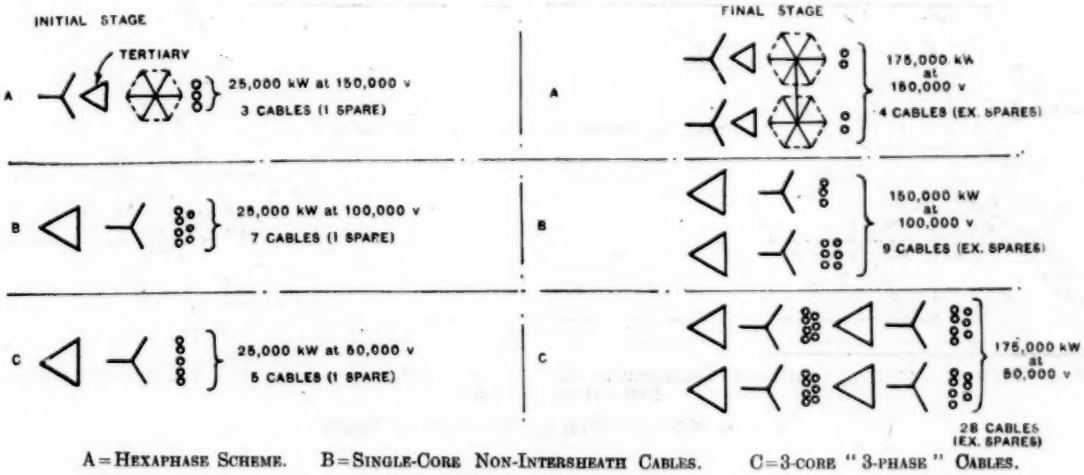
Before proceeding to describe the author's hexaphase system, a few words as to single-core cables may help to correct some wrong ideas. It has been already pointed out that an intersheath cable will stand 95 per cent. more voltage than a non-intersheath cable. This represents, for an equal percentage drop, 1/3.8 of the cross section of the copper per phase. To give equal security from breakdown, as compared with the hexaphase system (employing *four* cables), there must be at least *six* single-core cables, since, if there were only three cables, the breakdown of any one of these would immediately result in total interruption of supply. In the hexaphase system, one "hexagon," with its two cables, always acts as a spare to the other, continuing the supply until the spare cable can be introduced. In addition to this, the outermost intersheath—which is sure to be first to break down to earth—acts as a "tell tale" of impending trouble and, if the automatic gear operates sufficiently rapidly, the intermediate intersheath—or, at least, the central core—remains sound to earth, and can be used as a *second* stand-by in the event of the spare cable failing. There are thus four "second stand-bys" available, since one sound, and one damaged, cable can fed a "hexagon" in emergency.

On a single-core system, on the contrary, nothing is known of the incipient fault until the whole cable goes down, and *with it a complete "unit" of three-phase transmission.* whereas, with single-core cables, a *minimum* of six cables is necessary for equal security.

The manner in which a single hexaphase system can provide the necessary potentials for enlivening the cores of the cables will be assumed to have been gathered from the top part of fig. 7 of the author's I.E.E. paper, and the description relating thereto. It will also be understood how the lower part of fig. 7 of that paper simply consists of another "hexagon," whose phase condition is displaced 180 deg. from that of the first-mentioned "hexagon," and which may therefore be considered as twisted round its earthing point until it stands in an upside-down position in relation to the first hexagon. (To those unfamiliar with 6-phase work it may be helpful, in connection with what follows, to say that, in any 6-phase system, the vector voltage may be considered as a "diameter" of the "double-star" hexagon, which diameter rotates counter-clockwisely.) With the arrangement just described, there will be a certain moment when the rotating vectors of the *two* "hexagons" will both point vertically upwards. If, therefore, an external connection be taken from the extreme top of the upper, and from the extreme bottom of the lower, hexagon we get an external e.m.f. due to *twice* that of the one "hexagon."

(The fact that the earthing point does not fall on a radius of the hexagon is unimportant. The remedy is obvious.)

In a similar way, by substituting two hexagons for the bottom hexagon (as in fig. 10 of the author's I.E.E.



A = Hexaphase Scheme. B = Single-Core Non-Intersheath Cables. C = 3-core "3-phase" Cables.

Fig. 5.—50 Miles Transmission.

A glance at the above fig. 5 should be sufficient to indicate that, even for very *short* distances, the advantages of high voltage in reducing space required may be the deciding factor. Suppose, for instance, it was proposed to take power across London from, say, Barking to the West End, and to utilise the underground railway tunnels for the purpose, the difference between 4 cables and 27 cables (see fig. 5) would be a factor of supreme importance.

Referring still to fig. 5, the cost of nine single-core 0.4-sq. in. cables at, say, £60,000 each (for 30 miles) amounts to £540,000; while that of four "intersheath" 0.3-sq. in. cables amounts to, say, £264,000. The cost of twenty-seven 3-phase 0.15 sq. in. cables at, say, £60,000 apiece, amounts to £1,620,000; while the cost of four "intersheath" cables again only totals £264,000. It is also possible to initiate the transmission with a single intersheath cable (and a spare cable); paper) and properly changing the phase relations of their impulses, we obtain from the outside extremities of the three hexagons a 3-phase e.m.f. having 1.732 times that of a single hexagon. At the same time, however, each of the hexagons is functioning on its own account (and through its own two cables) as a 60,000-volt system, the "line e.m.f." being 117,000 volts.

Figs. 6 and 7, herewith presented, will give a clearer understanding as to how this double supply goes on. (Six figures are necessary to trace the operation through a complete cycle; but four of these are suppressed, for reasons of space.)

Referring in detail to these figures (which are based upon the vectorial diagram of connections given in the author's reply to the I.E.E. discussion, London), it will be seen that in fig. 6 there is a complete and self-contained electric circuit a_1 (sending end), a_1 (receiv-

ing end), d_1 (receiving end), d_1 (sending end), o^1 (sending end), a_1 (sending end).

This circuit operates at 60,000 volts; the current flows outwards through the central core of the *right-hand* top cable and returns homewards through the outermost intersheath of the left-hand top cable.

An instant later the circuit (c_1), (f_1), (f_1), (c_1) is similarly functioning, the outermost intersheath of the right-hand cable now operating in conjunction with the central core of the *left-hand* cable, again at 60,000 volts. It will be clear, therefore, that the outermost intersheaths are being effectively used to transmit power at 60,000 volts, whereas, in fig. 5 of the I.E.E. paper, the corresponding transmission would be of the order of from 17,000 to 15,000 V.

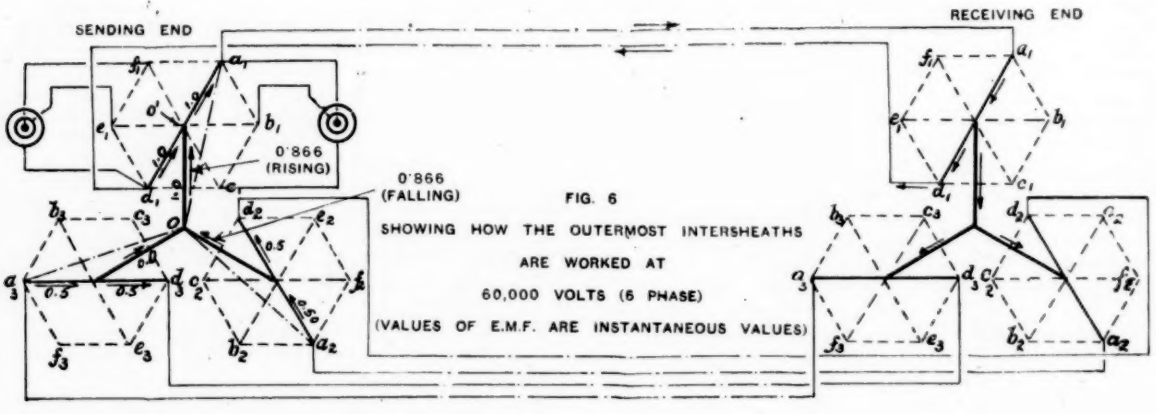
Referring again to the circuit (a_1), (a_1), (d_1), (d_1), it will be seen that the winding (Oo^1) at the sending end carrying capacity as compared with an ideal arrangement. The superposed current is passed through at a voltage of $67,500 \times \sqrt{3} = 117,000$ V.

Referring to the lower diagram, it will be seen that a similar superposed 3-phase current (Of_1), (Of_2), (Of_3) operates in conjunction with the first-mentioned one.

The action is equivalent to two distinct 3-phase superposed circuits, one leading the other by approximately 30 electrical degrees. The potential of the centre of the uppermost hexagon is determined by the length of the vector (Oo^1), the point (O) being earthed.

The voltages operating to charge the intersheaths of the right-hand cable are, of course, the vectors $(a_1\ b_1)$, $(b_1\ c_1)$, $(c_1\ O)$.

By constructing the four subsequent diagrams showing instantaneous currents on the hexaphase and 3-phase systems, it will be seen that the two systems work


SENDING END
RECEIVING END
0·866 (RISING)
0·866 (FALLING)
FIG. 6
SHOWING HOW THE OUTERMOST INTERSHEATHS ARE WORKED AT 60,000 VOLTS (6 PHASE)
(VALUES OF E.M.F. ARE INSTANTANEOUS VALUES)

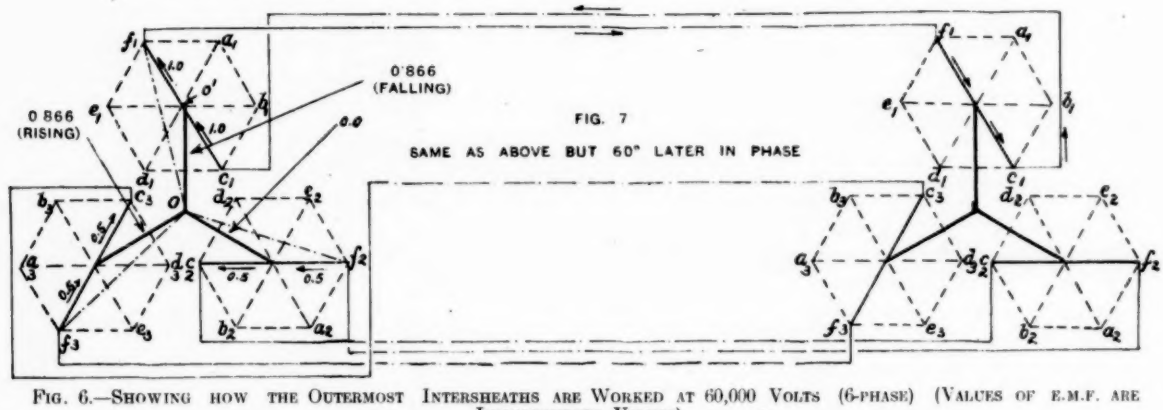


FIG. 6.—SHOWING HOW THE OUTERMOST INTERSHEATHS ARE WORKED AT 60,000 VOLTS (6-PHASE) (VALUES OF E.M.F. ARE INSTANTANEOUS VALUES).

FIG. 7.—SAME AS ABOVE, BUT 60° LATER IN PHASE.

injects a current into the said circuit at the point (o^1) and withdraws it at the corresponding point at the receiving end, as shown by the large arrows. It will be noted that, in the upper diagram, the current in (Oo^1) is at 0.866 of its maximum value and is rising; while in the lower diagram it is at 0.866 of its maximum value, but is falling. At a point intermediate in time between these two, it will be at its maximum value, and will feed *equally* into the two central cores of the cables.

Remembering that the point (O) is earthed, and treating the geometrical figure in the usual way as a vector diagram, we see that the combined effect of the e.m.f. in (Oo^1) and that in (o^1a^1) is to give a resultant voltage (Oa^1) in the phase represented by the dotted line (Oa^1) = 67,500 volts. This resultant voltage, in conjunction with the other limbs (Oa_2) and (Oa_3), superposes a current, in the central core (a_1) of the right-hand cable, on the current due to the 60,000-volt circuit through the same core, differing, however, from it by a small phase angle, involving a 5 per cent. loss in together in a completely harmonious way, that there is no inter-circuiting between one system and the other, and that if the central "star" at the sending end be first electrified and then the two hexagons (by closing the primary circuits of the transformers), the circuits at the receiving end will take up the respective e.m.f.'s impressed upon them just in the same manner as any ordinary bank of transformers.

Limitations of space prevent the author from touching upon numerous other points connected with the operation of the system; but he hopes sufficient has been said to establish the advantages claimed and to help towards a better understanding of its operation.

Correction.—On page 649 of our last issue, lines 54 and 55 in the left-hand column should read:—

kW loss with 12 cables (50,000 V) = 1,070 kW;
kW loss with 4 cables (150,000 V) = 1,300 kW.

TOTALLY ENCLOSED IRONCLAD SWITCHGEAR.

Messrs. Ferguson, Pailin's Completely Interlocked Type.

In interlocked switchgear separate handles are usually employed for controlling the oil switch, the isolating switches, and the earthing gear; in the improved interlocked gear which has just been developed by Messrs. Ferguson, Pailin, Ltd., one hand-wheel controls all the apparatus in correct sequence, without undue effort and without introducing intricate devices. The complications of interlocked gear have prevented its adoption in many instances, but the simplicity of this new arrangement, as will be seen from the illustrations, enables it to be installed with advantage wherever interlocked switchgear is required.

This type of switchgear is suitable for use in high-pressure and e.h.p. sub-stations, as well as for controlling plant in generating stations where the normal capacity does not exceed 10,000 kVA. The three-phase rupturing capacity is 75,000 kVA, but a larger size of oil-immersed circuit breaker can be supplied having a rupturing capacity of 200,000 kVA.

The switchgear is constructed on the sectional unit principle, all unit cubicles being similar in appearance and built accurately to the same dimensions. A unit section may, therefore, be installed singly in any circuit it is desired to control, or a number of sections may be grouped together at a distribution centre and connected to common busbars.

Referring to fig. 2, the handwheel A is provided with a pointer moving over a dial plate on the door, the top position of the pointer being in the "engage" position. From this position a clockwise movement of the handwheel closes the circuit breaker, the "on" and "off" positions being clearly shown through a small window by a mechanically-operated indicator positively coupled to the circuit breaker. Hand release is obtained by a thumb-push B, fig. 2, which is situated at the centre of the handwheel, and by means of which the breaker is tripped mechanically. When the circuit breaker is open it is then possible to give the hand-wheel a counter-clockwise rotation into the "engage" position; a further counterclockwise rotation then opens the isolating switches, which are provided with auxiliary contacts for earthing the disconnected apparatus, thus relieving it of any static charges. The door of the oil-immersed circuit-breaker compartment can now be opened for inspection, the automatic releases on the circuit-breaker can be checked, but an interlock prevents the door being closed unless the breaker is in the "off" position. The doors of the isolating switch compartments cannot be opened until the breaker is in the "off" position and the padlocks are removed, while overlap catches C, fig. 1, ensure that the doors of the isolating switch compartment must be closed in advance of the breaker compartment doors. When the doors have been closed a clockwise rotation given to the hand-wheel closes the isolating switches and brings the pointer to the "engage" position, and a further clockwise rotation closes the circuit breaker. The use of one hand-wheel for the whole of the sequence of switching is an important exclusive feature of F.P. switchgear, the operating of which is greatly simplified and may be safely left to unskilled and non-technical labour; furthermore, the interlocks are positive: that is, unless the correct sequence is observed the gear cannot be operated and no damage can result, either to the operator or the system.

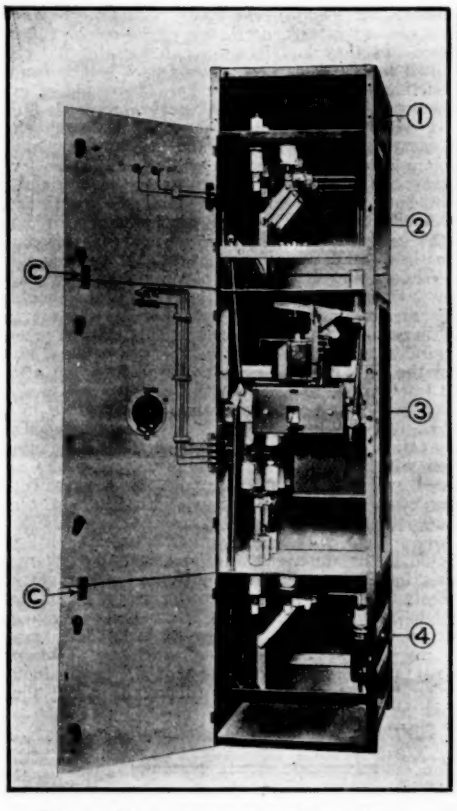


Fig. 1.—Front View, with Doors Open.

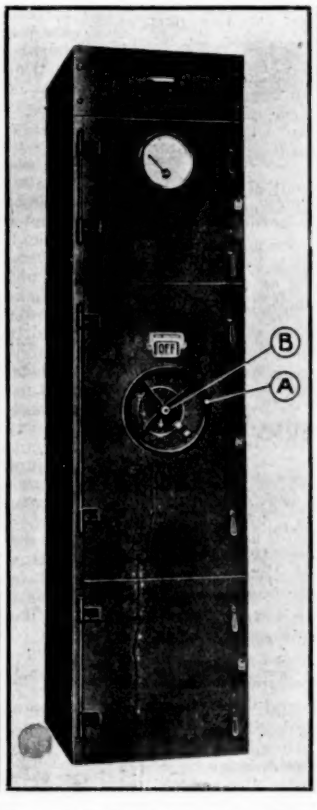


Fig. 2.—Complete Standard Cubicle.

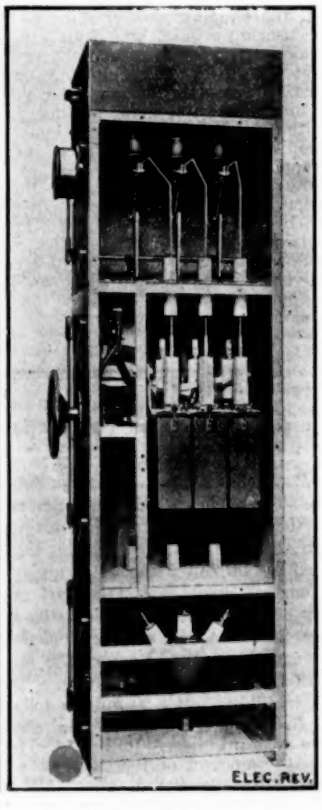


Fig. 3.—Side View, with Casing Removed.

As will be seen from the illustrations, each cubicle is rigidly constructed in cellular form, built up with heavy-gauge steel plates and angle iron, the plates being neatly trimmed and fitted without gaps to prevent, as far as possible, the entrance of dust. The doors are free from large holes, and are thus, to a great extent, dustproof. If extra protection from dust and moisture is required the doors and casing can be fitted with felt gaskets at the joints, and the top cover can be made to project so that any moisture will drip clear of the front.

The front view of a typical cubicle with doors closed is shown in fig. 2, and a front view of the interior arrangement is shown in fig. 1, with the doors open. Beginning at the top the standard cubicle, referring to fig. 1, is arranged in the following compartments:—

1. Busbar and terminal compartment.
2. Busbar isolating switch compartment.
3. Oil-immersed circuit-breaker and current-transformer compartment.
4. Circuit-isolating switches (when required) and potential-transformer compartment.

The various interlocks are as follows:—

1. It is not possible to open or close the isolating switches until the circuit-breaker is in the "off" position.
2. The circuit-breaker compartment door cannot be opened until the isolating switches are open and the isolated apparatus earthed.
3. The isolating switches cannot be closed until the earth circuit is broken and the doors of the compartment are closed.

4. When the circuit-breaker compartment is open the operation of the breaker may be checked, but the door of the compartment cannot be closed unless the breaker is in the "off" position.
5. It is not possible to operate the isolating switches except by means of the hand-wheel, with the door closed.

The hand-wheel is so arranged that a feeder, machine, or transformer may be kept "dead" by simply padlocking the hand-wheel in the "off" position.

The isolating switches are of the knife type, all contacts being carefully ground in during assembly. Each switch is a separate unit, coupled by means of driving rods of specially-treated hard wood with metal-bushed ends to the main operating spindle, which is actuated by the hand-wheel, fig. 3. The wood driving rods are required to pass an alternating pressure test of 10,000 volts per inch before assembly. The actuating mechanism is so arranged that safety catches are not required, as the action of the toggle mechanism is sufficient to prevent the switch opening either by gravity or on account of the electromagnetic forces due to large rushes of current under fault conditions. The circuit-breaker may be of the automatic or non-automatic type, as required. The former is usually supplied, but for such purposes as busbar sectionalising the latter can be substituted.

The lever gear is of the true loose-handle type, the automatic features being operative at any part of the travel of the operating lever. The lever gear is of the power reduction type, requiring a minimum of effort to close and open the breaker, yet being quite unaffected by vibration or mechanical shock. It is not possible to open the breaker slowly by hand; the tripping plunger must be used for this purpose, thus ensuring a quick and definite break. When the circuit-breaker has operated under fault or overload conditions it is not possible to close it completely until the conditions which caused its automatic operation have been removed. For use in conjunction with motor-starting devices, in order to prevent the circuit-breaker being closed except when the starting device is in the correct position, an electrical interlock can be supplied.

The instruments are mounted on the front of the panel, the connections to the current and potential transformers being made by phase-coloured insulated fireproof wiring run on porcelain cleats, see fig. 1. The connections between the swing doors and the fixed element are made by means of terminal boards and flexible leads, no links or similar devices being employed on the fronts of the panels, thus facilitating the manipulation of the gear.

THE FIXATION OF ATMOSPHERIC NITROGEN.

Mr. E. Kilburn Scott, who has delivered a series of three Cantor lectures before the Royal Society of Arts on "Nitrates from the Air," gave some interesting details in his second lecture, on April 16th, concerning the large electric arc plant erected by the American Government at Muscle Shoals, on the Tenessee River, during the war. Apart from the technical details of the plant, it is noteworthy that it was finished just before the armistice was concluded, and consequently has never actually produced any of the products for which it was intended, *viz.*, explosive material. The original vote of Congress, in 1916, was for 20 million dollars, and difficulties were immediately encountered on the chemical side which need not be gone into here. In 1917, the following year to that in which the erection of the plant was started, a contract was entered into with the American Cyanamide Co., which had a plant on the Canadian side of Niagara Falls, and this company in eight months and four days built a plant capable of producing 40,000 tons of fixed nitrogen per annum. As already stated, however, the plant never actually came into operation, and it has been standing idle ever since. A number of offers have been received to work it commercially, and an outstanding one is by Mr. Henry Ford, who has proposed to spend 100 million dollars in extensions of various sorts, making the plant easily convertible for war purposes in the future if required. The total expenditure already involved is 107 million dollars. For the moment, the various offers are under the consideration of the American Government, and Mr. Kilburn Scott states that nothing will now be done until Congress meets later in the year. So far as the electric furnace plant at the works is concerned, there are twelve furnaces, rectangular in shape, 12 ft. x 22 ft. x 6 ft. deep inside, made of steel open at the top and lined with fire brick. The electrodes are carbon blocks 16 in. square x 6 ft. 5 in. long. An area is planed at each side of one end of these carbon blocks so that the metal head can make good electrical contact. Two holes are bored, and a copper electrode head is secured in by special bolts, three of these blocks being fastened together as a unit covered with wire netting with a protecting layer of asbestos and retort cement which is baked on in an electric furnace. One complete electrode weighs 7,000 lb., and during the reaction the electrode is consumed at the rate of 70 lb. of carbon per ton of carbide manufactured. Three of the complete electrodes are suspended from arms over the top of the furnace. The immersion of the electrodes in the molten bath is controlled electrically. The bus-bars of each electrode are 5/16 in. x 8 in. wide, and there are 16 bars to each electrode. The voltage for the carbide furnaces is 130 volts, stepped down from 12,000 volts by a bank of transformers, the capacity being 8,325 kW. When operating normally the current is 20,000 amperes. The normal capacity per furnace is 50 tons per day of 24 hours. The temperature attained in the furnace is 3,000 deg. C.

There are sixteen rows of furnaces and 96 in a row, or 1,536 ovens in all, each furnace being 4 ft. 4 in. outside diameter x 2 ft. 10 in. inside x 5 ft. 4 in. deep, and having a steel shell with a 9-in. lining of fire-brick. To charge the oven, a cylindrical paper container 2 ft. 6 in. in diameter, with a vertical paper tube 3 in. in diameter in the centre, is inserted in the cold oven, and a charge of about 1,600 lb. of pulverised carbide is run in. There is an annular space of 2 in. between the paper container and the brick lining of the oven. The carbon electrode, a ¾-in. pencil 6 ft. 6 in. long, is inserted inside the paper tube. Two covers are put on, the outer cover being luted with sand. Nitrogen is brought to the furnace by an 8-in. spiral riveted pipe, and from this two 1½-in. pipes run, one to the centre, and the other to the side, 6 in. above the bottom—each provided with a valve.

Electric current (single-phase) at 100 volts and 200 to 250 amps. is put on for 20 minutes, then at 50 volts and 100 to 115 amps. for 12 hours, and the reaction continues for 28 hours longer. The temperature is about 2,000 deg. F, and the material sinters together to form a solid pig. Of course, when the electric current is turned on, the papier-mâché tubes are burnt away, but they last long enough for the material to hold up until the particles begin to sinter together from the heat of reaction and finally make a hard dense pig of cyanamide. It contracts considerably. After the process is finished the pig is removed by grabbing it with two spoon-shaped jaws and carrying it to the cooling and grinding rooms.

The remainder of the description of the plant given by the lecturer was of the chemical apparatus and operations, but throughout both the present lecture and the previous one given on April 9th, Mr. Kilburn Scott has emphasised most strongly the need for some efforts to be made in this country to develop the electrical fixation of atmospheric nitrogen from the air. Whilst being the inventor of a direct arc process himself, he urged that those working on these lines should co-operate in order to avoid overlapping research. The one great trouble with regard to the development of electrical processes in this country was the manner in which one found oneself up against the Chile nitrate interests the moment an attempt was made to obtain capital. Nevertheless, electrical processes were being worked on the Continent, and yet we in this country had not a single plant. It was recommended that electrical fixation of nitrogen processes should be operated in conjunction with such water powers as we have here as an off-peak load, and also in connection with the super-power stations using coal. It was shown how, with Chile nitrates at £9 per ton, it had been proved cheaper to make nitric acid by the arc process with energy at £7 10s. per kW-year. Energy could be obtained at a much cheaper rate than this, and in his usual emphatic and enthusiastic manner, Mr. Kilburn Scott insisted that the present position ought not to be allowed to continue. Quite apart from the national question of explosives supply in the case of war, there was the enormous market for the fertilisers which were obtainable from the arc process, and he claimed that all the products required for both purposes can be made more cheaply by the arc process than by any other.

Life-saving at Sea.—A report of the Merchant Shipping Advisory Committee on life-saving appliances on passenger steamers was issued by the Board of Trade on April 23rd. In addition to its former recommendation that boats and rafts should be provided for all on board, the committee recommends that: Motor-lifeboats fitted with wireless telegraphy should be carried on vessels carrying more than 10 boats. Illumination of the lifeboats in launching and immediately after being launched should be provided.—*Daily Mail.*

An invention for the automatic illumination of lifeboats when they are launched from a ship's side has just been tested by Board of Trade officials. The inventors are two partners in the firm of Messrs. T. Blair & Co., ship's store merchants, in East London. By their device two small electric lamps are switched on by contact established from a float contained in a tube fixed to the sternpost of the lifeboat. The float is forced up the tube by water when the boat is launched. Storage batteries capable of giving 24 hours' continuous light to the lamps are carried on board. Under present Board of Trade regulations every ship's lifeboat has to carry an oil lamp and a dozen boxes of matches in a sealed watertight tin. The inventors of the new device claim that it will eliminate much of the risk of lifeboats being run down.—*Evening News.*

THE DRIVE OF POWER-STATION AUXILIARIES.

By L. BREACH, M.I.E.E., and H. MIDGLEY, B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

WHEN preparing a scheme for the auxiliaries of a power station one of the first questions which arises is as to the purpose of the station, *i.e.*, whether it is for constant running on a high-load factor, whether it is for an ordinary commercial load, with an annual load factor of about 30 per cent., or whether it may only have to run for a few hours in the year, as in the case of a station which acts as a stand-by to a hydro-electric undertaking. It is obvious that an expenditure upon auxiliaries which would be justified in the case of a central supply station feeding an important industrial area would be extravagant in the case of a stand-by station. In this paper attention has been confined to a modern station equipped with large turbo-alternators, mechanical stoking, &c., and to the supply of power for auxiliaries; no attempt has been made to discuss the merits and demerits of such apparatus as evaporators, ejectors, &c.

Three main aspects of the question are dealt with; they are as follows: (1) The consideration of the different types of auxiliaries which may be used in a station and their individual requirements and relative importance. (2) The consideration of the different types of supplies available for the auxiliaries. (3) The consideration of the suitability of different combinations of auxiliaries and supplies under different conditions.

The auxiliaries in a station may be grouped according to the length of time during which they may be shut down without causing serious inconvenience or damage. This time depends upon the importance of keeping the station, or individual alternators, on load without intermission.

It may be taken as an axiom that in a large power station, with turbo-alternators of not less than 10,000-kW capacity each, loss of vacuum must be avoided at all costs. Not only does the output fall by about 60 per cent. when the turbine exhausts to atmosphere, but the rise of temperature of the blades at the low pressure end may cause serious distortion and damage.

Auxiliaries may be divided into four types: (*a*) Those which must not stop on any account. This includes the main circulating water supply, the air extraction, and station lighting. Pumps must be in duplicate, each of sufficient size to carry the load without too great a loss of vacuum, and each driven from a separate source of supply. The chances of both supplies failing at once are very slight.

The next class (*b*) comprises those auxiliaries which must not stop for more than, say, 60 seconds, as the boiler-feed pump and the power for the control circuits. Consequent upon the high rates of evaporation now obtained in water-tube boilers the water level will fall to a dangerous degree if the feed supply fails for more than about a minute when the boilers are on full load. This group must be so arranged that in the event of failure of supply another is immediately available. For the boiler-feed pumps one of the most suitable schemes is to have one motor-driven rotary pump and one steam-driven pump for each group of boilers.

An alternative supply must also be available for class (*c*). This includes those auxiliaries which may stop for about five minutes but no more, as water extraction, individual stokers, individual forced-draught and induced-draught fans, and ventilating fans. This type may be so arranged that they may all be fed from either of two alternative supplies, the change-over being effected by means of selector switches. Class (*d*) contains those auxiliaries which may stop for a period of up to about 12 hours without shutting down the station—coil and ash conveyors, coal crushers, pumps for water-softening plant, and economiser-scraper motors. In this case it is usual to carry spares for such parts as are likely to cause trouble, *e.g.*, motor armatures. These can be installed without entailing a shut-down of more than a few hours.

In the consideration of the different types of supply available each must be examined as to its suitability in the following circumstances: Starting up, for the first set on a system and also for subsequent sets; running on full load and no load; shutting down any section of the system; and all conditions of faults on the electrical end of the station and of the system. The following points must also receive attention: reliability, simplicity, attention required, first cost, effect on overall efficiency of the station, complete working costs (including capital charges), and the effect upon feed temperature or "heat balance." Reliability should take precedence of cost.

The first type of drive considered is the direct steam drive by turbine or engine. This requires more attention than the electrical drive but has the advantage of being independent of electrical faults. Unfortunately at times of heavy load, when the auxiliaries are most needed the power and speed fall. This has a cumulative effect, which may necessitate shutting down. Attention has to be paid to the many steam-pipe joints, and the increased radiation surfaces reduce the overall thermal efficiency of the station. Further, the use of direct steam drive almost doubles the make-up. The one auxiliary for which direct steam drive is especially suitable is the boiler feed pump.

An electrical drive from a main alternator *via* h.p. busbars can be employed. This may be at the busbar voltage or reduced by transformers if a.c. Now that the building of a.c. motors of above 50 h.p. for pressures higher than 400/500 V is a matter of little difficulty the use of the main generation voltage or, at any rate, a voltage of the order of 3,000, merits careful attention. A main voltage of 6,600 would be too high for any motors except those for the main circulating pumps. A pressure of 3,000 V would be suitable for the latter and for the air-pump and extraction-pump motors (where these are driven by the same motor), and the boiler-feed pump motor, but there appears to be little advantage in stepping down to this pressure; it seems just as well to step right down to 400 V rather than introduce an intermediate pressure. Comparing a.c. and d.c. motors, it may be said that the latter require more attention than the former, but they can be subjected to speed regulation over a wide range, and can be run off a battery in case of emergency. The speed regulation of a.c. motors is not economical. The "cascade" principle might be employed but this gives only a limited number of speeds. A.c. motors, however, can run for very long periods without attention, although they cannot be operated from a battery. A supply can be taken direct from the machine terminals, with the advantage that the opening of the main switch does not cut off the auxiliary supply. At the Dalmarnock (Glasgow) station a supply for the auxiliaries of certain sets is taken from the main alternator *via* special windings on the main transformers. This system is only suitable for a station in which the step-up transformers are directly coupled to their respective alternators and the switching is carried out on the high-pressure side. The system which is most popular in this country is the taking of a supply from a special house set. There are several ways of dealing with the exhaust steam from these sets. In the case of a station in which, for long periods, only one main set is on load, one house set per main turbine would possibly be more economical in steam consumption, but the capital cost is greater. The authors express the opinion that the best arrangement is to have two sets per station, one on load and the other for stand-by purposes. The last method of supply is by means of a special generator on the main alternator shaft. Whether this should be a.c. or d.c. is open to discussion. If a d.c. machine it would be run in parallel with the other d.c. plant and the battery, and of course a certain number of d.c. motors would be required. The a.c. machine would be simpler but it could not be used directly in parallel. The excitation would have to be considered; the best source of this would be the battery.

In addition to the internal arrangements the position of the station must be taken into consideration. Stations may be divided into the following classes: isolated, supplying an area or individual works; one of several stations supplying an area, but not permanently linked up; as the last, but permanently linked up; and a station used as a stand-by.

The authors put forward seven definite alternative schemes for a station containing five 25,000-kW turbo-alternators, of which four would be required for maximum load. Steam would be obtained from four boiler-houses, each supplying full-load steam for one turbine, and containing six boilers, five of which would be required for maximum load. Each turbine would have two separate circulating pumps, each with its own motor, and two air and two extraction pumps, with two motors between them. The boiler-feed arrangements are the same in all the schemes, each boiler-house containing one electrically-driven feed pump and one turbine-driven feed pump, either of which is capable of supplying the whole boiler-house, and both are available for immediate use. Six motors are available for the stokers of each boiler house, but only three are required at any one time, the other three being immediately available for use by the operation of clutches. Except for the stand-by feed pump, steam-driven auxiliaries have not been considered because the authors are of opinion that any extra economy obtained by their use is not a sufficient return for the additional attention which they require. The busbars are in four sections, and the h.p. system is also in four sections, coupled only at the main stations and not at the sub-stations. Details as to the tying of these sections, whether by a tie bar with reactances, or by reactance in the generators, are outside the scope of the paper. The authors suggest that the control of the switches feeding the sub-busbar and of those sectionalising it should be in the main h.p. control room of the station, the mimic bar on the main board including a section showing the sub-busbar. By this means the possibility of an error in switching on the high-pressure side of the station auxiliary system would be reduced to a minimum. Synchronous motor-generators are only put forward where it is necessary to provide for feeding the a.c. bars from the d.c. bars. In all other cases induction motors

are proposed because they are much less likely to trip out at times of fault and they are more easily started. Rotary converters have only been proposed for one of the schemes owing to the greater reliability of motor-generators. Reference is made to the difficulty of changing over from one a.c. supply to another. The schemes deal only with the first three classes of auxiliary, excluding conveyor motors and others under the "12-hour" group.

Scheme 1 employs a special d.c. generator on the shaft of the main turbo-alternator. The d.c. machine would be self-exciting and fitted with a reverse-current relay. In this scheme the maintenance required would be fairly great because of the large number of d.c. motors and a considerable number of spares would have to be carried, as both a.c. and d.c. motors are employed. There is much to commend the scheme if the d.c. generator can be considered a reliable proposition. Commutation would probably be the greatest difficulty.

Scheme 2 involves the use of two auxiliary a.c. busbars, each fed by a transformer. This arrangement is simple in operation, efficient, and does not require a considerable amount of maintenance.

Scheme 3 embodies a special a.c. generator on the shaft of the main turbo-alternator for turbine auxiliary motors only. It would be necessary in this scheme to run to atmosphere the first turbine to be put on load, but if, before starting, the auxiliary generator were switched on to the motors which it normally feeds, these motors would run up to speed with the generator, and it appears possible that a vacuum might be obtained sufficiently quickly to avoid any distortion troubles in the main turbine. This arrangement is simple in operation, efficient, and does not require a very considerable amount of maintenance. The special a.c. generator should be more satisfactory in use than the d.c generator of Scheme 1.

Scheme 4 employs a special a.c. generator on the shaft of the main turbo-alternator for turbine and boiler-house auxiliary motors. This arrangement is efficient, does not require a considerable amount of maintenance, and the spares required are a minimum. It should be reliable in operation, but there appears to be a great risk of mistakes occurring in the use of the change-over switch and, in addition, this will probably be an expensive piece of apparatus.

Scheme 5, which has a special winding on the main step-up transformer, is efficient, and does not require much maintenance. The exact degree of reliability is open to question, but, providing that a fault on the main 33,000-V busbars does not affect all the auxiliary supplies to such a degree as to shut down the motors fed from them, it may be considered as sufficiently reliable for adoption so long as there is more than one set on load. A certain amount of care will be required in the use of the change-over switches.

Scheme 6, which employs two auxiliary busbars, fed respectively by a transformer and a motor-generator, is reliable, simple in operation, flexible, and fairly efficient. It would require a fair amount of maintenance because of the large number of d.c. motors used and the spares required would be considerable. As a large battery would be required the first cost of the scheme would be high.

Scheme 7 embodies two a.c. auxiliary busbars, fed respectively from a motor-generator and a condensing house service turbo-generator. The efficiency of this scheme would be lower than that of a scheme in which all the auxiliary supply is obtained by the motive power of the main turbines; but, on the other hand, there are no complications in starting up or running. The spares to be carried would be more than for all a.c. auxiliaries, but less than where they are partly a.c. and partly d.c. Maintenance would probably be high because of the large number of commutators and brush-gear. The scheme would be simple to operate and highly reliable, the only drawback being the extra attention required because of the inclusion of a house set. An alternative scheme, similar to this, in which a.c. motors are used throughout, might be put forward, the motor generators being replaced by transformers, the house set being a.c., and the battery being fed from the auxiliary busbars by way of reversible motor-generators.

In considering the relative merits of the foregoing schemes it must be borne in mind that they are only typical and that it might be advantageous to adopt combinations of some of the alternatives. On broad lines the schemes may be placed in three groups of approximately equal merit: Nos. 1, 6 and 7; Nos. 2, 3 and 5; and No. 4, which is an example of what to avoid.

The authors acknowledge the assistance of Mr. H. Dickinson.

Discussion in London.

The paper was read on April 26th at the Institution by Mr. L. Breach, and in the ensuing discussion

Mr. W. B. Woodhouse said that it was good to see such an insistance upon reliability at a time when the reduction of production costs was unduly stressed. The improvement of the operation of coal- and ash-handling plant would make a great difference to the thermal efficiency of a station. It was rather striking that d.c. was proposed in three of the systems; the authors' objections to the d.c. motor were not serious, the atmosphere of power stations was clean and the ability of the motors in the hands of a competent staff was good. If the rigid links in a.c. systems could be got rid of the question of auxiliaries would be simplified. The tendency was against a large number of steam-driven auxiliaries; these were suitable for large stations but out of the question for smaller stations.

Mr. H. Brazil said that this country's superiority in the matter of continuity of supply should be preserved. He estimated that a London company shutting down for two hours would lose £1,000 in revenue and its consumers would probably lose far more. He thought that boiler-feed pumps should have been included in the class of auxiliaries which must not stop on any account, and twelve hours was a long stop for one ash conveyor. Synchronous motor-generators were very advantageous but there was a difficulty in changing over from one source of supply to another.

Mr. J. S. Highfield did not consider that systems Nos. 1, 6 and 7 in the paper were of equal merit—he preferred system No. 7 to the other two. Feed pumps should be run from an absolutely independent supply; the other auxiliary plant could be run from the busbars. The best economy could be obtained by using the waste heat from the auxiliary turbines.

Mr. L. M. Jockel said that the result of running a large turbo-alternator, exhausting to atmosphere, for more than two minutes would be disastrous. He thought that the air extraction plant might be put into the same class as the water extraction pumps. Independent ventilating fans could be shut down for long periods if the output of the set was reduced. He considered that the authors might have paid more attention to the thermo-dynamic aspect of the subject. The synchronous motor-generator was preferable to the rotary converter owing to the danger of the latter's slipping a pole and reversing the current, which would necessitate the installation of reverse-current relays. He disputed the statement that the house-turbine system was the most popular in this country.

Mr. W. E. Highfield pointed out that in three of the schemes put forward a generator driven from the main turbine shaft was employed. It was possible to design a d.c. machine for the high speed involved, but such a machine could not compare with one constructed for a lower speed. The shaft would run through a critical speed, differing from that of the alternator, and another flexible coupling and two extra bearings would have to be provided. This would be a great drawback to the three schemes. The authors mentioned a group of boilers fed by one steam pump and one electric pump. This system appeared to be uncontrollable at half or less than half load.

Mr. J. R. Cowie demurred from the authors' classification of coal and ash conveyors, stating that in some stations the coal was brought straight from a railway siding. A second conveyor would often be cheaper than the provision of 12-hours' storage capacity. He stated that satisfactory switchgear for changing over from one a.c. supply to another was in operation in many parts of the country. He would have preferred to see the use of a.c. in System No. 7. The employment of a 3,000-V supply for auxiliaries was quite common. There was one station now under construction in which both h.p. and l.p. a.c., and d.c. were used. The use of the commutator motor might have been considered among the methods of driving auxiliaries, and the paper might have gone further and shown how the power was distributed to the auxiliaries.

Mr. H. Midgley replied to the various points raised by the speakers. He again emphasised the fact that the authors did not set out to say which was the best system, but merely to put alternative schemes forward for consideration. Regarding the rigidity of a.c. systems, he suggested that the placing of reactances between the sections of the main busbars would secure flexibility. Their objections to the horse-turbine were that it involved the employment of extra staff. The shutting-down limit of the ash plant depended upon its design. If it were possible to install induction motors instead of synchronous motors this should certainly be done. By classing Systems 1, 6 and 7 together they did not suggest that these were equal in merit—they were the three best. It appeared to be the general opinion of engineers that the air-extraction pump was more important than the water-extraction plant. Full consideration of the thermo-dynamic aspect was not possible in a paper of this nature. With regard to the question of the auxiliaries for a boiler group, a rotary-type feed pump with a suitable characteristic would guard against danger from pressure rises. He thought that most stations would have at least 12 hours' supply of coal in their bunkers. He did not agree that a.c. would show any advantage over d.c. in Scheme 7. The a.c. commutator motor would no doubt be useful in some cases, but in a station where the supply was close at hand the advantage was doubtful.

Ljungström Air-Heater.—Technical experts state that the air-heater invented by the Swedish engineer, M. Ljungström, will render possible a more extensive use of home-produced fuel. Trials with Swedish coal from the Hoegenaes mines are said to have given satisfactory results.—*Reuter's Trade Service* (Stockholm).

"EXIDE" BATTERIES IN THE POLAR REGIONS.

(Communicated.)

The Arctic explorer, Donald MacMillan, has returned from Baffin Land with much new evidence of the value of storage batteries on Polar expeditions. The fact is now fully demonstrated that storage batteries are necessary equipment, not only in connection with the scientific work of polar exploration, but because of their value in adding to the comfort of the men and the maintenance of their morale.

Storage batteries furnished current for ignition in the oil engine of the *Bowdoin*, MacMillan's staunch vessel. There was also an electric light plant equipped with the "Exide" type of storage batteries. With this plant MacMillan's men enjoyed freedom from the horrors of the Arctic winter darkness that would make generations of former polar adventurers green with envy could they but know of it. The same batteries furnished current for the operation of a kinematograph, and many otherwise weary hours of enforced inactivity were passed away with the help of moving pictures accompanied by suitable selections from a talking machine.

The Eskimos themselves were tremendously affected by these contrivances of the white men. MacMillan tells the story of an Eskimo employed by the Hudson Bay Co., in solitary charge of a post some forty to fifty miles from where the *Bowdoin* made winter quarters. This Eskimo heard rumours of the wonderful battery-operated electric lights which rivalled the summer sun for brilliance and surpassed the Northern Lights for usefulness. Excited by the Arctic gossip, he loaded his sledge with provisions, placed his two children on the load and, with his wife helping him in the traces, he trudged his way for two days over the pathless plain to see for himself if such a wonder might really be. He made his goal the second night out and is reported to have stood at a short distance from the lighted vessel for an hour or two gazing at the (to him) most astonishing sight. Then, his mind at rest, he turned round for the journey back to his deserted post, for the leaving of which he might be punished.

MacMillan's story—"New Trails in the Ice Wilderness," copyrighted by *The Boston Globe*—contains many references to the use of storage batteries and the lighting plant and kinematograph, and the following extracts are used with the permission of the *Globe*.

In his story he pictures the value of these modern accessories to Arctic exploration in maintaining the good spirits of the men under discouraging conditions. He says in one place: "When we awoke in the morning (the *Bowdoin* was now in the heart of an ice pack in Fox Channel, on the Arctic Circle), it was blowing hard from a little east of north, with a mixture of rain, snow and fog. The whole pack was drifting south and taking the *Bowdoin* involuntarily along with it.

"To take our thoughts for a few hours away from such a discouraging sight, we unpacked our kinematograph. Our "Delco" plant, equipped with "Exide" batteries, with which the *Bowdoin* was lighted, supplied us with power. We simply snapped a button and were off into the busy world to the south. If the donors of the machine only knew how we enjoyed that hour or so up in Fox Channel locked in the ice, and the many, many happy hours we spent later in winter quarters, I know they would feel well repaid for their generosity."

In another place he says: "We invited the Eskimos to come on board to their first moving-picture show. We showed them pictures of life in the States and in various parts of the world, and ended with a picture of the Eskimos at Etah, North Greenland, and in Hudson Bay. What their feelings were it is hard to imagine. Some were so absorbed that they sat like stone images, while others gave vent to their feelings by a deep 'Ke-pee' (wonderful)."

The instruments designed and built for this expedition by the Carnegie Institute for the observation of the variations in local terrestrial magnetism were in charge of Ralph H. Goddard, one of the scientists of the expedition. The observatory in which they were placed was on the shore, about 400 feet distant from the *Bowdoin*. It was built after the style of a large refrigerator, but its purpose was to keep the cold out and not in. The inside dimensions were 12 ft. x 6 ft. x 6 ft. high, and three thicknesses of plaster board with 1½ in. air spaces between were used in building the instrument room. Then a stone building was erected around the first building, leaving a three-foot passage all round the inner room. The stone building was roofed with timber covered with canvas, and the whole exterior was plastered over with about six inches of packed snow. The entrance was protected by an Eskimo type of ice house, called an igloo. Altogether there were five doors to pass through in entering the instrument room. Two oil-lamp heaters were kept going in the three-foot passage way, and thus the temperature was constantly maintained at about minus five degrees centigrade.

The inner or instrument room was really a photographic dark room filled with self-registering magnetic variation apparatus. For instance, one set of three instruments had magnetic needles with tiny mirrors on one end. A two-candle-power lamp with a mirror reflector was so focused as to cast a ray of light on to the magnetic needle mirrors, which in turn reflected back pencils of light to a large recording cylinder of sensitised paper upon which was thus written the story they had to tell.

The recording cylinder was revolved by clockwork, and the photographic film-like paper was renewed each day for the record of the next twenty-four hours. Altogether there were seven of these pencils of light writing their daily hieroglyphics on the magnetogram for later interpretation by the scientists of the Carnegie Institute.

One kept track of the variation in temperature. Three were guardians of the "base lines" and checked the faithfulness of the instruments in sticking to their respective jobs. The other three were those which did the tattling of the inner secrets of the newly discovered region which no white man had ever seen before. One measured vertical intensity, another the horizontal intensity, and the third, by the clever use of a torsion head, measured the variation in declination; that is, the variation of the magnetic north from true north.

Mr. Dawson Howell was in charge of the "P.G.," or potential gradient instrument, which had a separate two-candle-power lamp and a separate recorder. The "P.G." was a quadrant electrometer connected by an insulated wire with a "collector" post a hundred feet away. This post was about six feet high, and was capped with an ionium cup. The "P.G." instrument covered the electrostatic conditions by measuring the variation in potential between the top of the post and the ground in the instrument room.

The average reading was plus 300 volts, and the reading sometimes ran as high as plus 500 volts. Under the influence of the Northern Lights the "P.G." light would positively dance with excitement, and under certain conditions a high wind had a similar effect.

It was made possible to accumulate all this scientific information by using a regular 6-volt, 120-ampere-hour "Exide" wireless battery. This particular battery deserves a niche of its own in the Arctic Hall of Fame; its record of faithful service under difficult conditions reflects credit on both its maker and its caretaker. From May 3rd, 1921, to September 22nd, 1922, this battery furnished current at a high discharge rate to heat the igniter plugs of the *Bowdoin's* engine. It was used continuously as the "A" battery for the ship's wireless receiving set, and every day for over seven months it sent current over four hundred feet of cable to light the lamps in the instrument house.

Mr. Harold Whitehouse, of Boothbay Harbour, Maine, engineer of the *Bowdoin*, and in immediate charge of the batteries, says: "I can give nothing but the highest recommendation for the "Exide" batteries on the MacMillan expedition. This small battery particularly was on the job day and night for seven and a half months while we were in the Arctic regions, and was always at our service during the entire fourteen months of the trip. To-day (September 22nd, 1922), it is as good as ever, testing 1.250 sp. gr. this morning."

Report on Railway Accident.—Col. J. W. Pringle has reported to the Ministry of Transport upon a collision which occurred near Retford (L. & N.E. Railway) on February 13th. On this occasion an Aberdeen sleeping-car express ran into the rear of a goods train which was being backed into a siding. The driver and fireman of the express and a locomotive inspector were killed and 22 passengers suffered minor injuries and shock. The brake van and 16 wagons of the goods train were destroyed, and the engine of the express, its tender, and the leading coach were overturned, while two other coaches were derailed. All the passenger coaches and the brake vans of the express were electrically lighted and no fire occurred. The Inspector states that the accident was directly due to the failure of the enginemen of the express to observe and obey the danger position of signals. This case is typical of the class of accident preventable by automatic train control. If the attention of the enginemen had been called to the warning position of the two distant signals by means of an automatic partial brake application, it is probable that the collision would have been prevented. The railway companies have appointed a joint committee to consider the recommendations made by the Automatic Train Control Committee and the circumstances of this case will no doubt receive full attention.

The Aluminium Industry.—The question of the state of the negotiations for the formation of an international price convention in the aluminium industry was raised at the recent annual meeting of the Aluminium Industry Co., of Neuhausen. In reply, the chairman is reported to have stated that a price convention with certain countries had come into operation, but efforts were being made to bring about a general convention. It was added that French competition should not be underestimated, although it was not acute at present.

ALLOYS RESISTANT TO CORROSION.

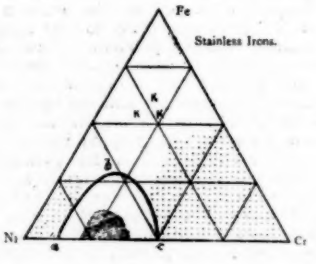
The subject of the new non-corrodible alloys, ferrous and non-ferrous, was the subject of the latest of the general discussions organised by the Faraday Society. The meeting took place at Sheffield, on April 13th, and it was held jointly with the local sections of the Institute of Metals and the Manchester Metallurgical Society. While a great amount of empirical data and information relating to these alloys was put forward, no generally-acceptable explanation of their non-corrodibility was forthcoming and, as so frequently happens, experiment and practice in this subject are decidedly ahead of theory.

The only theoretical paper presented was one by Mr. Ulick R. Evans dealing with the mechanism of the so-called "dry corrosion" of metals, that is when an invisible film of water is present on the metal, volatile electrolytes such as HCl, SO_2 or CO_2, NH_3, &c., being also, in some cases, present in the atmosphere. The paper did not deal specifically with alloys, but its conclusions, while not unexpected, are of general application. Corrosion of apparently dry metals is greatly accelerated by the presence of volatile electrolytes, SO_2 being most dangerous to iron and steel, NH_3 to copper and its alloys, and HCl to zinc and aluminium. The presence of some moisture is essential to corrosion, which is electrolytic in origin, the function of the volatile electrolytes being to increase the conductivity of the film; but it occurs where the air is decidedly unsaturated. When hygroscopic corrosion products are formed more water is attracted to the film and this may be the cause of serious cases of corrosion, but it occurs where the air is unsaturated. Special phenomena occur at the contact of dissimilar metals, and afford sometimes electro-chemical protection. This may explain the non-corrodibility of alloys in some cases.

The general paper, on "The Corrosion of Industrial Metals," was presented by Dr. W. H. Hatfield. It contained the results of a variety of corrosion tests made in 21 different metals and alloys in common use. The tests show conclusively that there are now available steels and non-ferrous alloys effective in resisting ordinary corroding influences, but no general rules can be laid down on the corrodibility or acid-resisting powers of any metal or alloy. Every particular application requires actual practical experiments to be made, for corrodibility depends on the nature of the corroding agent as well as on the composition of the metal, and factors such as heat and mechanical treatment of the metals, and temperature and other extraneous influences have also to be considered. On the theoretical side Dr. Hatfield was not able to put forward any generalisation. There is not even a simple relationship between solubility and electrode potential of the metal. Certainly rapid solution takes place when the potential is highly negative and little corrosion or chemical action takes place when the potential has a high positive value—apart from that the magnitude of the potential gives no indication of the solution properties of a metal. This noteworthy results is borne out by the fact that many alloys which are homogeneous in structure are readily attacked by many reagents while some which are decidedly heterogeneous are among the most resistant, for example, high silicon iron (tantiron), nichrome, and stainless steel.

This conclusion of Dr. Hatfield's was combated by Mr. J. H. G. Monypenny in his paper on "The Resistance to Corrosion of Stainless Steel and Iron," where it was maintained that in these alloys (which are essentially steel containing 11 to 14 per cent. chromium and about 0.3 per cent. carbon) the greatest resistance to corrosion is obtained after quenching in such a manner as to give a homogeneous martensite, while the least resistant form is obtained on annealing the steel so as to produce a complete separation of carbide and ferrite. In the former case the temperature of quenching must be sufficiently high (say 900-950 deg. C.), so that all the carbide is dissolved in the steel; in the latter, the separation of the carbide not only tends to decrease resistance to corrosion owing to galvanic effects, but also it lowers the concentration of the chromium in solution in the iron (much of the chromium separates out with the carbide) and hence the ground mass of iron is not so insoluble as when it contained all the chromium in solid solution. Tempering a stainless steel up to about 500 deg. C. removes the internal stresses and improves the toughness, but the structure of the steel remains martensitic, and so its resistance to corrosion is unaltered. On the other hand, tempering at temperatures of 600 deg. or over throws the carbide out of solution; the material falls in hardness and its resistance to corrosion is diminished. Mr. Monypenny also discussed in a similar manner the effects of annealing stainless steels. The effect of cold working, such as rough machining, is to decrease its resistance to corrosion. The effects of varying the composition and of the inclusion of such metals as silicon and nickel were also studied, as were the actions of different corroding agents, but reference must be made to the original paper for a detailed account of these matters. The case of atmospheric corrosion only calls for brief mention here. Samples exposed for prolonged periods to impure town air became covered with a dark brown coating, which sometimes could be rubbed off, leaving an unimpaired surface, which under severe conditions had the effect of slightly pitting the steel. In pure air, stainless steel remained unattacked for long periods, and it also resisted remarkably well the action of superheated steam.

Another group of heat and acid-resisting alloys, namely, certain nickel-chromium and nickel-chromium-iron combinations, was dealt with by Mr. J. Ferdinand Kayser. These alloys have various uses in the arts; thus, furnace parts and case-hardening boxes may be made from the nickel-chromium alloy containing 25 to 35 per cent. chromium, while the alloys with 10 to 15 per cent. chromium are used in the manufacture of "Nichrome" resistance wire. The effect of the chromium is to enable such wire to be used indefinitely at temperatures of 1,000 deg. C. or over without any appearance of brittleness. The ternary alloy (Ni-Cr-Fe) arose on account of the substitution of ferro-chrome for the more expensive pure chromium. Mr. Kayser showed a most interesting diagram, reproduced below, giving some of the important properties of these alloys. The three corners correspond to the pure metals.



Most of the heat and acid resisting alloys fall within the area *a b c*, while the highest class fall within the shaded zone in that area. The dotted zones contain no commercially useful alloys. The zone K has so far been neglected by English metallurgists, but the Germans have been exploring it, and it was thought to promise useful rustless alloys. The effect of the addition of other elements, such as carbon, silicon, aluminium, manganese and copper was discussed by Mr. Kayser. The influence of aluminium is noteworthy; it has a remarkable hardening effect upon nickel and nickel-chromium alloys. For a fuller account of this interesting series, including their physical as well as their corrosion-resisting properties at high temperatures, reference must be made to Mr. Kayser's paper as well as to a paper by Mr. J. H. S. Dickenson, read before the Iron and Steel Institute in 1922. An important point brought out by the latter author, and confirmed by Mr. Kayser, was that at high temperatures steels and alloys behave like viscous fluids and cannot be said to have any definite strength at a red heat.

A short paper by Mr. John Arnott dealt with monel metal which is eminently suitable for parts and fittings that have to resist sea water, impure water, such as is often found in canals or mines, steam, dilute acid and alkaline solutions.

The meeting was productive of a mild sensation in the announcement by Mr. Harold Turner of a new sterling silver resistant to ordinary—or even to Sheffield—atmospheric tarnishing. This alloy, the composition of which was not stated, contains over 92½ per cent. silver so that it may be hall-marked. It has only just been placed upon the market, but specimens were exhibited which had been in ordinary domestic use for two years without having been cleaned with any polishing medium.

THE IMPROVEMENT OF POWER FACTOR.

Discussion at Glasgow.

The late Dr. G. Kapp's paper on the above subject (which was abstracted in our issue of November 24th, 1922) was read by Mr. R. B. Mitchell at the Scottish Centre of the Institution of Electrical Engineers on April 10th, Mr. A. S. Hampton presiding over a rather small attendance.

Mr. C. W. Marshall thought that it seemed obvious that the consumer of electricity should provide for his own supply of wattless current, except in cases where the supply was very small. In the paper the cost of static condensers was given as £3 per kVA. On the Glasgow system, the alternators cost £1.25 per kVA, step-up transformers £0.6 per kVA, step-down transformers £0.9 per kVA, and main transmission cable

£0.4 per 1,000 yards per kVA, which items alone exceed the figure given above. In any definite case the figures could be taken out in this way and the most advantageous way of supplying the consumer could be settled. The most serious drawback to the methods of charging suggested was that no really satisfactory kVA meter had yet been devised, so that no matter how desirable such tariffs might be, it was impossible to carry them out in practice. A further difficulty would be that it would be almost impossible to persuade consumers to adopt the tariffs owing to the difficulty of explaining them.

Mr. R. Nelson (of Messrs. Merz & McLellan) said that in the Yorkshire district a number of collieries had installed Helsby condensers with considerable advantage. Broadly speaking, the cost of the condenser was recovered in from two to three years from the time of installation. Power factor improvement to about .8 was round about the practical figure.

The Commonwealth Edison Co., of Chicago, reserved the right to enter consumers' premises and test the power factor at any time, and if found to be below .7 reserved the further right of withdrawing the supply. The threat in this case appeared to be sufficient.

Mr. G. G. Braid thought the diagram prepared by Mr. Mitchell, showing the power factor of various undertakings, extremely interesting. It would be a good thing if the British Engineering Standards Committee would draw up a specification for induction motors, or indeed a.c. power plant generally, which would call for a reasonably high power factor at all loads. He did not envy the power supply engineer who tried to explain the reason for all the clauses in tariff agreements to the ordinary non-technical consumer. If a fairly flat rate could be introduced, say, one for lighting and another for power and heating, with reductions for large consumers and power taken during the periods of light load, and perhaps some restrictions or penalties for cases of very low power factor (even if a slightly higher charge were then made to cover risks) the consumer would be more satisfied, as he would then know exactly what he was paying for.

Mr. F. H. Whysall's feeling was that power factor had been neglected by the power companies. In Greenock they had not been very much troubled with the question, and his experience had been that it was comparatively easy to explain the position to a consumer and get him to conform to their ideas on the subject. They were always glad to supply consumers with a specification for suitable power plant. Where the supply was taken at some distance from the power station a static condenser was very satisfactory. The difficulty in recording kVA would be got over very soon. They had been experimenting with a two-meter system and could get a very accurate figure of the average power factor throughout the working period. Where it was necessary they could, of course, very readily get the actual kVA and could threaten to charge the defaulting consumer on a kVA basis.

Mr. A. E. Kelly said that the Kapp vibrator was a particularly simple piece of apparatus and had the advantage that it could be adapted to almost any slip-ring motor. The other apparatus mentioned by the author showed equally good results and if all consumers realised the effect of such auxiliary appliances, they would install them more readily. The supply companies were entitled to give some rebate for the saving in mains or increase in carrying capacity of their present mains, and this was generally done.

Mr. A. E. McColl did not think that many of them realised actually what power factor cost. He reviewed all the losses which might occur in a large system, and showed that all the time they were moving in a vicious circle. The losses directly due to low power factor ran into five figures. He did not agree with Mr. Whysall that power factor troubles would cure themselves; they had got to aid the cure by prohibitive tariffs. Supply engineers had got to demonstrate to consumers that the benefits were such that the rebate allowed would suffice to pay the interest charges on the phase-advancing plant. He had investigated a number of installations, and in all cases advised the consumer to put in a static condenser. The increased losses, including operating expenses, labour, &c., simply ruled the rotary condenser out of court.

Mr. J. F. Nielson pointed out that he had installed a 6,000-kVA static condenser, which had maintained constantly a power factor of unity and they had got the full allowance offered by the Clyde Valley Co. They had repaid in 15 months approximately 25 per cent. of the cost of the condenser, and it was bought at a time when prices were high. The cost was near £8 per kVA, but in spite of that they were thoroughly satisfied with what they had done; the condenser would repay itself in about three years' time. The objection to phase-advancing plant for general improvement was that in dull times large motors were not always running constantly. For general power-factor improvement he strongly advocated the use of the static condenser to begin with.

The Chairman (Mr. A. S. Hampton) stated that the discussion would be replied to by Prof. Miles Walker.

THE LIGHTING OF PRINTING WORKS.

At the meeting of the Illuminating Engineering Society on April 24th, presided over by Mr. F. W. Bridges, a paper on the above subject was read by Mr. L. Gaster.

The paper was concerned with the lighting requirements, both of journalists who prepare matter for publication, and printers whose art makes this information available to the public. Good lighting was particularly important in the printing industry in view of the high standard of work, coupled with speed of execution, now demanded. To a modern newspaper a breakdown of machinery, or a bad error in the editorial department, might be of serious consequence, and inadequate lighting greatly increased the risk of such occurences; moreover, the cost of lighting usually formed only about 1 per cent. of the wages bill, so that the expenditure necessary to secure good lighting was not a heavy item. If better lighting resulted even in a small improvement in quality of work it would fully justify the expense.

Three methods of lighting rooms containing compositors' frames were mentioned: (*a*) bare unscreened lamps allotted to each frame and slightly above it; (*b*) lamps similarly situated, but provided with reflectors, to screen the light from the workers' eyes; and (*c*) general lighting from sources (usually semi-indirect) situated between the frames. The first method was a bad one, as it caused glare in the eyes of the worker and left the drawers at the side of the frame in shadow; the second method removed the defect of glare, but was still apt to cast an inconvenient shadow on drawers, unless supplemented by general overhead lighting. The third method was now used in many modern compositors' rooms. Mr. Gaster showed a number of lantern slides of typical installations, including both obsolete and modern methods. In some cases an illumination throughout the room up to 10 foot-candles was now provided. In view of the exacting nature of the work probably 5 foot-candles on the frames should be regarded as a minimum.

The lighting of machine rooms presented difficulties owing to the fact of the rooms being often nearly filled by huge rotary presses. Light surroundings were helpful in enabling diffused light to penetrate into interstices in the machinery; but it was difficult to do this effectively by general lighting, and designers of machinery might consider the incorporation of arrangements for permanent shielded lights as an essential feature of the design. It should be possible to throw a flood of light on any part of the machine without the eyes of operators being dazzled by exposed filaments.

In the concluding portion of the paper Mr. Gaster laid stress on the provision of proper lighting in editorial offices. In some newspaper works where the lighting of the printing departments was relatively good the conditions of illumination in the editorial offices were inadequate. In journalistic work one was concerned, not only with clear type on white paper, but also with more or less illegible manuscript and roughly-executed proofs. Reporters' copy was sometimes presented in pencil writing on flimsy or partially glazed paper, which was particularly difficult to decipher without a good light. Proof-readers in general preferred a well-shaded local light which might give 10 foot-candles or more on the work.

In conclusion, it was suggested that the Society should appoint a small joint committee to consider these problems in detail.

The discussion was opened by the Rt. Hon. C. W. Bowerman, who, as a Past President of the Joint Industrial Council of the Printing and Allied Trades of the United Kingdom, expressed his warm approval of the paper and welcomed the investigation which the Society had set on foot.

Mr. A. E. Goodwin and Mr. Holmes, joint secretaries of the Council, also expressed their appreciation of the importance of good lighting; and Mrs. A. Bridge, Chairman of the Health Committee of the Council, mentioned that it was their intention to make a special study of lighting conditions in the printing trade; in this connection they would welcome the assistance of the Society. Amongst others who spoke were Mr. J. R. Riddell (Principal of the London School of Printing), Mr. G. A. Isaacs (Secretary of the National Society of Operative Printers and Assistants), and Mr. G. W. Mascord (United Newspapers, Ltd).

An Italian Engineering Journal.—The Pirelli-General Cable Works, Ltd., Southampton, draws our attention to the *Journal* of the Italian Electrical Association, which is likely to be of considerable interest to British engineers. It deals very fully with the latest engineering developments on the Continent, and particularly with water-power plant and power transmission at high voltages. In addition railway electrification receives a great deal of attention. The *Journal* is published three times a month, and the annual subscription is only the nominal one of £1. Any engineer desiring to become a subscriber should get into touch with Mr. G. Martinez at the Pirelli-General Cable Works.

PARLIAMENTARY NOTES.

[By Our Special Parliamentary Reporter.]

The Oakham Gas and Electricity Bill.—*Gas Company's Powers to Supply Electricity.*—The Unopposed Committee of the House of Lords, presided over by the Lord Chairman (the Earl of Donoughmore) ordered to be reported for third reading, on Tuesday last week, the Oakham Gas and Electricity Bill, subject to the approval by the Lord Chairman of a number of clauses which have been added. The Bill provides for the change of name of the Oakham Gas Co., Ltd., to The Oakham Gas & Electricity Co., Ltd., and empowers the company to supply electricity for all public and private purposes in the area which is now supplied with gas by the company. Provision is made for the erection and working of a generating station subject to the consent of the Electricity Commissioners.

The maximum price to be charged is 1s. per kWh. The Bill will empower the company to raise further share capital not exceeding £9,000, provided that the share capital shall not exceed in the whole £27,000. Borrowing powers are also conferred on the company. Separate accounts are to be kept of the gas and electricity undertakings. The standard rates of dividend which may be paid by the company on ordinary shares and stock are not to exceed, in the case of the original capital of £8,000 authorised by the company's Order of 1888, 10 per cent. per annum, and on all other ordinary shares and stock, 7 per cent. per annum.

City and South London Railway Bill.—A Committee of the House of Commons, presided over by Sir Park Goff, considered this Bill on April 25th and subsequent days. Sir Lynden Macassey, K.C., for the promoters, said that the object of the Bill was to authorise the extension of the railway from Clapham Common to Morden *via* Balham, Tooting and Merton, where it would join the Wimbledon and Sutton Railway; and also to confer running powers over the latter railway. It was proposed to raise £4,550,000 additional capital, and employment would be provided for 20,000 men for a period of two years. The length of the extension would be about six miles, roughly five of which would be underground and the remainder on the surface. A clause in the Bill enabled the City & South London Railway Co. and other companies to subscribe for the securities of the Wimbledon and Sutton Railway Co., enabling it to carry out the works delayed by the war. The principal objection came from the Southern Railway Co., on the ground of competition. Lord Ashfield gave evidence in support of the Bill, and in cross-examination by Mr. McMillan, K.C., for the Southern Railway Co., denied that there was the intention to compete with the company for the traffic from Wimbledon. He further stated that whatever the Southern Railway Co. might do, by extension or electrification, it would not give so good a service as that which would be provided by the present scheme. Evidence to the same effect was given by Messrs. F. Pick and Basil Mott, and the representatives of a number of local authorities in the districts affected. The Hon. Evan Charteris, K.C., appeared for Mr. Hatfield, part of whose property it was proposed to acquire under the Bill. He stated that his client's objections were based on the danger of the amenities of the district being adversely affected by the scheme. The promoters failed to come to an agreement with Mr. Hatfield and the Committee adjourned until April 30th.

The hearing of evidence was continued on April 30th and May 1st. Sir H. A. Walker (general manager of the South-Western Section of the Southern Railway) referred to the proposals as an invasion of the territory which had been granted to the Southern Railway Co. by statute, and said that it would result in the diversion of traffic from the Southern Railway to the new line. Other witnesses, who gave evidence to the same effect, were Sir William Forbes (general manager of the London, Brighton & South Coast Section) and Mr. F. J. C. Pole (general manager of the Great Western Railway). Mr. McMillan said that any success achieved by the extension would be obtained at the expense of the Southern Railway Co.

Sir Lynden Macassey, K.C., in the course of summing up the case of the City & South London Railway Co., said that it was significant that throughout the inquiry no one had suggested that the people of the districts concerned would not be benefited by the scheme.

This concluded the proceedings, and the Chairman said that the Committee's decision would be announced the following day.

This decision was in the following terms:—"The Committee are of the opinion that in the public interest and as a matter of public policy the preamble is proved."

Cost of Electric Lighting.—On April 24th, Sir Philip Pilditch asked the President of the Board of Trade if he was aware that the cost of electricity for lighting was 1s. and 11d. per unit in Twickenham and Teddington, whilst at Fulham and Wandsworth it was only 5d. and at Richmond (Surrey) 7¼d.; and if he would take steps to lower the cost of electricity in Twickenham and Teddington to a more reasonable figure.

Colonel Wilfrid Ashley (Parliamentary Secretary to the Ministry of Transport), who replied, said that, owing to the differences in the conditions under which the supply of electricity was given in different localities there was no necessary relation between the prices charged in such localities. There was machinery under the Electricity (Supply) Act, 1922, whereby the Minister of Transport was authorised to revise maximum prices on the application of the undertakers, the local authority (where that authority was not the undertaker), or an appropriate number of consumers, at recurring intervals of three years.

Imperial Radio Communication.—On April 24th, Sir W. Joynson-Hicks informed Mr. Hurd that negotiations on the subject of granting licences to private enterprise for radio-telegraph services between this country and the Dominions, Colonies and foreign countries were still in progress.

Rural Telephones and Telegraphs.—On April 24th, Sir W. Joynson-Hicks informed Mr. Foot that the number of rural post offices without call office facilities was approximately 8,500 and the number of railway stations in rural districts without exchange telephone facilities was about 2,600. Five new rural telephone call offices had been provided in the county of Cornwall during the past 12 months.

Replying to Sir Thomas Henderson, Sir W. Joynson-Hicks said that telegraph business was already performed by the railway companies on behalf of the Post Office at a large number of rural railway stations, but the facilities were generally confined to the acceptance of telegrams and to delivery on the station premises—the companies as a rule being unable to provide a delivery service to the general public. He had no power to compel railway companies to undertake post office telegraph business, but where such facilities were desirable in the public interest efforts were made to induce them to do so.

Cairo Radio Station.—On April 24th, Sir W. Joynson-Hicks informed Sir D. Newton that the actual expenses of the Cairo station, including the salaries and allowances of the operating and engineering staffs, maintenance, administrative, and overhead charges, were estimated at about £36,000 per annum. A further £13,000 represented the estimated provision to be made for interest and amortisation of capital. The revenue of the station, which was opened less than a year ago, was increasing, the revenue for the third quarter being 65 per cent. higher than the first and 15 per cent. higher than the second.

Coal Exports.—On April 24th, Lt.-Col. Lane-Fox, Secretary for Mines, informed Brig.-Gen. Spears that the quantity of coal exported to Germany from this country in the three months January, February and March was 3,358,350 tons, as compared with 2,163,520 tons during the previous three months.

Radio Broadcasting.—Answering Capt. W. Benn, Sir W. Joynson-Hicks, Postmaster-General, said that the importation of radio apparatus was not at present prohibited, but the provision that apparatus used under the broadcasting receiving licence must be marked with the British Broadcasting Co.'s trademark prevented the use of imported apparatus for ordinary broadcasting reception as distinct from experimental purposes. There was no similar provision in respect of apparatus used under the experimental licences.

Unemployment.—During a debate on the Vote for the Ministry of Labour, Sir M. Barlow, the Minister, referring to unemployment, said that the Government programme with regard to unemployment fell under three headings—relief works; stimulation and development of foreign trade, mainly by the Exports Credits Scheme of the Trade Facilities Act; and the Unemployment Insurance Acts provisions. With regard to the Industrial Training Scheme, the position was as follows:—Trained, 64,600; in training, 14,400; on waiting list, 6,300; awaiting improverships, 3,500. The key to the problem of the industrial training of the disabled men was found in the Government Instructional Factory. As to the King's Roll, he said that it would only require a very small effort by every employer who employed from 20 to 25 workpeople and over, to find employment for practically the whole of the disabled men out of work. In fact, if, on the average, every such employer took on two additional men, the work would be done.

Dr. Macnamara, the former Minister, in urging the establishment of some permanent scheme to anticipate and deal with periods of unemployment, said that the Ministry of Labour ought to be at work examining schemes of great public utility, such as arterial roads, electrical power development, canals, waterways, afforestation, and land reclamation. The Ministry should also invite the Joint Industrial Councils under the Whitley scheme to consider insurance by industry, and see whether it was not possible, in private industrial concerns, so to adjust operation as to secure greater continuity of employment, notwithstanding trade fluctuations.

Smokeless Coal.—On April 25th, Mr. Hardie asked the Minister of Health whether his department would frame a scheme for the scientific treatment of raw coal.

Mr. N. Chamberlain said he was advised that the formulation of a practical scheme for such a treatment of coal must await the solution of engineering problems which had been and were still engaging the active attention of the Fuel Research Board, and independent workers.

Private Bill.—On April 30th, the Metropolitan Railway (Various Powers) Bill was read a third time in the House of Commons.

LEGAL.

American Penstock Valve Patent Decision.

A Court decision of importance to those interested in hydro-electric power development has been made by Judge Westenhaver, in the U.S. District Court for Northern Ohio, sitting in Cleveland. In this decision, Judge Westenhaver affirms the validity of the basic Johnson penstock valve patent, and finds the Wellman-Seaver-Morgan Co., of Cleveland, guilty of infringement, in the suit brought by the William Cramp & Sons Ship & Engine Building Co. The patent in question is one of the best-known in the recent history of hydraulic engineering.

The Cramp Co. acquired the commercial rights to the Johnson patent about two years ago. At that time these valves were being marketed by the Larner-Johnson Valve & Engineering Co., of Philadelphia, and previous to this arrangement they had been manufactured by the Wellman-Seaver-Morgan Co., under a royalty agreement with Mr. Johnson. Shortly thereafter the Wellman-Seaver-Morgan Co. placed a valve on the market in competition with the Johnson valve as manufactured by the Cramp Co., which the former maintained to be a distinct and original design, although performing the same function as the Johnson valve. The Cramp Co. immediately served notice of infringement, and the suit just decided followed in due course.

Claim for Revocation of Patent.

Before Mr. Justice Sargant, in the High Court of Justice, a claim was made by Malcolm Quelch for the revocation of letters patent No. 10,189, of 1913, granted to August Merk-Wirz, of Zurich, and at present owned by Silent Guides, Ltd., London. According to *The Times* report, the petitioner claimed that he had recently invented a new and improved advertising device for which he had applied for letters patent No. 175,356 by an application dated November 4th, 1920. The petitioner's device comprised, broadly, an advertising apparatus consisting of a screen containing space for advertising matter and also a map or diagram of the locality wherein the advertiser's premises were situated, and having means for selecting and illuminating the diagrams at points corresponding with the positions at which the various advertisers' premises were situated.

The petitioner alleged that the manufacture, exhibition, and sale of apparatus constructed in accordance with his invention had recently been interfered with by the Silent Guides, Ltd., who represented that, by reason of their ownership of letters patent No. 10,189, of 1913, they were entitled to restrain the manufacture, exhibition, and sale of any apparatus wherein a chart or map was illuminated by means of electric lamps arranged at the back of the apparatus at certain marked points.

The petitioner claimed that letters patent No. 10,189, of 1913, were invalid, and asked for their revocation.

There was exhibited in Court as an example of the "Silent Guide" a diagram of the Underground Map of London (which had been for some time at Leicester Square Station), with on either side a list of principal places of amusement, &c., in London, against each of which was an electric button. The traveller selected the place that he desired to reach and pressed the appropriate button. Thereupon the place where the Silent Guide was erected was shown by a large red light; the point where a change of train had to be made to reach the desired point was shown by a green light; the point where the traveller would have to alight was shown by a red light; and the actual position of the place of amusement, &c., selected was indicated by a white light.

In the course of his judgment, Mr. Justice Sargant examined the alleged anticipations and came to the conclusion that none of them anticipated the respondent's patent. The petition was dismissed.

Armanni v. Rauber.

At the Marylebone County Court, on April 30th, Lingi Armanni, an electrical contractor, sued Ernest Rauber, a confectioner, for two monthly instalments of the price of a shop-window stand.

Plaintiff stated that the stand was supplied to the defendant at a price of £67 10s., of which £25 5s. was paid at once and the balance was due in six monthly instalments. The stand was revolved by an electric motor and there were a number of lamps connected with it.

The defendant stated that he purchased the stand under the impression that plaintiff had arranged with the electricity supply company to provide energy at the power rate of 2d. per kWh, but he found that he was charged at the lighting rate of 7d. per kWh.

As an agreement signed by the defendant contained nothing to this effect Judge Scully gave judgment for plaintiff for the amount of £37 18s. 6d. and costs.

British Thomson-Houston Patents.

In the Chancery Division, on April 25th, Mr. Justice Sargant was informed of the settlement of the action brought by the British Thomson-Houston Co., Ltd., against Goodmans (Leeds), Ltd.

Mr. Trevor Watson, for plaintiffs, said the defendants consented to judgment in the ordinary form according to minutes agreed between the parties. The action was brought on plaintiffs' gasfilled lamp patent.

Mr. Draper, for the defendants, said that it was a case of innocent infringement and he must consent to the injunction. Defendants were jewellers and had taken a few lamps from tenant for rent.

His Lordship entered judgment on the terms agreed.

Shemeld v. Antrim County Council.

In the King's Bench Division of the Northern Ireland High Court, before Mr. Justice Brown, an action was brought by John Wardell Shemeld and James Albert D. Shemeld, minors, through their aunt, Sarah Wardell Shemeld, against the Antrim County Council, for £10,000 damages in respect of the death of their father, John Wardell Shemeld, electrical engineer, Antrim Road, Belfast, who was killed by his motor-cycle colliding with a heap of stones on the public road at Portrush on August 12th, 1922. In the result the action was settled on an award of £2,450, together with taxed costs.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

10,231. "Telephone receivers." A. C. Brown. April 16th.

10,241. "Telephone cord terminals." G. Turnock. April 16th.

10,242. "Suspension insulators for electric transmission lines." Soc. Ceramica Richard-Ginori. April 16th. (Italy, April 20th, 1922.)

10,243. "Suspension insulators for electric transmission lines." Soc. Ceramica Richard-Ginori. April 16th. (Italy, November 15th, 1922.)

10,252. "Inductance tubes for wireless apparatus." H. Bailey. April 16th.

10,254. "Hydrometers for testing electrolyte in electric storage batteries." A. J. Evans. April 16th.

10,255. "Methods for treating sulphated plates of electric storage batteries." A. J. Evans. April 16th.

10,265. "Stair-cases for passenger vehicles." Metropolitan Electric Tramways, Ltd. April 16th.

10,267. "Storage batteries." F. J. West. April 16th.

10,269. "Gramophone device for wireless reception." A. C. Gunstone. April 16th.

10,271. "Circuit-breaker." H. Cartier. April 16th. (France, May 9th, 1922.)

10,273. "Connector for making electric contact between telephone tags and terminal." H. E. Harrison. April 16th.

10,289. "Electrically-controlled door fastenings." R. H. Buxton and C. M. Croft. April 16th.

10,290. "Radio telephony." J. L. Bégin. April 16th.

10,291. "Crystal detectors." B. Jackson. April 16th.

10,292. "Inductance and resistance coils, &c." B. Jackson. April 16th.

10,295. "Electric pocket lamps." G. Cailler. April 16th. (Switzerland, April 15th, 1922.)

10,297. "Electric circuit-interrupters." Metropolitan-Vickers Electrical Co., Ltd. April 16th. (United States, April 18th, 1922.)

10,303. "Automatic cut-out for electric boiling-vessels." P. R. Clark, E. E. Edwards, and G. G. Koop. April 16th.

10,308. "Wireless telephone apparatus." W. T. Saunders. April 16th.

10,315. "Electric discharge tubes." C. G. Eden and General Electric Co., Ltd. April 16th.

10,318. "Electrically-heated ovens." C. A. Baker. April 16th.

10,321. "Electric radiators, &c." E. L. Pease. April 16th.

10,324. "Telephone exchange systems." R. C. Arter. April 16th. (United States, April 17th, 1922.)

10,333. "Sound-emitting, &c., instruments." British Thomson-Houston Co., Ltd., J. H. Butcher and A. P. Young. April 16th.

10,343. "Collecting and utilising terrestial, &c., electricity." J. Guillot. April 16th.

10,345. "High-frequency alternators." N. Oboukhoff. April 16th.

10,351. "Dynamo-electric machines." British Electric Plant Co., Ltd., and A. W. Maudling. April 16th.

10,352. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 16th. (United States, September 11th, 1922.)

10,353. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. April 16th.

10,359. "Forming continuous electrodes." A. Helfenstein. April 16th.

10,364. "Mast for wireless aerials." A. Drew. April 17th.

10,373. "Switching for multi-circuit radio receivers." R. S. Bunting, W. Parkinson, E. A. Taylor, and L. E. Taylor. April 17th.

10,374. "Telephone, &c., receivers." J. Walton. April 17th.

10,382. "Crystal cups for wireless receiving sets." W. H. Brown and A. Ford-Lloyd. April 17th.

10,385. "Fuse plug." H. E. V. Brücner. April 17th. (Germany, April 19th, 1922.)

10,388. "Sound amplifying and directing appliances." G. A. Morris. April 17th.

10,414. "Electric terminals." A. S. Cubitt. April 17th.

10,427. "Wireless receiving circuits." S. T. Buer and Western Electric Co., Ltd. April 17th.

10,432. "Joints in electric cables." A. E. Foster and Siemens Bros. & Co., Ltd. April 17th.

10,433. "Commutators for dynamo-electric machines, &c." English Electric Co., Ltd., and E. H. H. Hassler. April 17th.

10,435. "Sound-amplifying devices for telephone, &c., receivers." P. A. Garrett and G. W. Irwin. April 17th.

10,437. "Tuning wireless telephone circuits." E. J. Toomey and S. Wiseman. April 17th.

10,439. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. April 17th. (United States, May 12th, 1922.)

10,441. "Telephone receivers." A. R. Bradman. April 17th.

10,445. "Variometer inductances." T. K. Barnard. April 17th.

10,452. "Electric maximum-demand indicating and recording means." A. T. Cooper. April 17th.

10,471. "Wireless telephone receivers." F. L. Hollister. April 17th.

10,479. "Terminals for electric conductors." E. L. Wiegand. April 17th.

10,480. "Electric heating-devices." E. L. Wiegand. April 17th. (United States, February 1st.)

10,482. "Manufacture of electric incandescent lamps." M. P. Pedersen and N. F. Prass. April 17th. (Germany, July 28th, 1922.)

10,488. "Arrangements for responding to or detecting small variations of electric current." F. A. Johnsen. April 17th.

10,490. "Method of producing a direct current of a required tension from a direct-current supply of a different tension." B. M. J. Davis and Wireless Equipment, Ltd. April 17th.

10,491. "Potential control apparatus." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). April 17th.

10,500. "Pocket wireless receiving apparatus." J. N. Huntly. April 18th.

10,503. "Electric light attachment." J. Dutson. April 18th.

10,510. "Underground railways." C. H. Verity. April 18th.

10,511. "Rail joint." C. H. Verity. April 18th.

10,512. "Means for tuning inductance coils." A. Marr and J. H. Williams. April 18th.

10,522. "Apparatus for localisation of faults in electric storage battery cells." P. J. Gates and Sudbury Auto Electrical Service. April 18th.

10,524. "Loud speakers for radio-telephony." A. W. Sharman. April 18th.

10,525. "Electric connecting plug for radiators, &c." A. T. Hutchinson. April 18th.

10,528. "Electric switches." J. A. Crabtree. April 18th.

10,532. "Pad for head telephones." S. Sheldon. April 18th.

10,537. "Electric switches." W. Heughan and St. Helens Cable & Rubber Co., Ltd. April 18th.

10,540. "Electric terminals." S. H. Sershall. April 18th.

10,545. "Electric cables." Callender's Cable & Construction Co., Ltd., and F. J. Cooper. April 18th.

10,551. "Oscillation generators." Western Electric Co., Ltd. April 18th. (United States, April 18th, 1922.)

10,552. "Combination connector for electric fittings." W. H. Sumner. April 18th.

10,559. "Lightning arresters, &c." W. K. Barker and W. J. Goodman. April 18th.

10,562. "Rectifier crystals for wireless telephony." C. J. Coleman. April 18th.

10,565. "Electric water-heaters." L. H. Paddle. April 18th.

10,568. "Gripping-device for crystals, &c., for wireless telegraphy." W. R. Mickelwright. April 18th.

10,570. "Wireless receiving apparatus." A. H. S. MacCallum. April 18th.

10,572. "Apparatus for electrically transmitting scenes, &c." W. S. Stephenson and G. W. Walton. April 18th.

10,579. "Electric converting apparatus." H. Barnes, English Electric Co., Ltd., and J. C. Wilson. April 18th.

10,585. "Apparatus for electrically transmitting scenes, &c." W. S. Stephenson and G. W. Walton. April 18th.

10,594. "Tramway, &c., rails." A. C. Neal. April 18th.

10,595. "Flashing electric signs." F. G. Galley and G. P. Kent. April 18th.

10,606. "Interlocking switch." R. C. B. Stillman. April 18th.

10,615. "Cabinets for wireless apparatus." E. A. Graham. April 18th.

10,616. "Thermionic valves." F. A. Cam and E. P. Liddell. April 18th.

10,623. "Receiving apparatus for wireless telegraphy." W. C. Davey. April 18th.

10,624. "Electric regulating resistance." R. Linse. April 18th. (Sweden, April 18th, 1922.)

10,641. "Gramophones, &c., adapted for use with loud-speaking, &c., apparatus." E. G. Pulford. April 19th.

10,642. "Trucks for electric tramcars, &c." P. Priestly. April 19th.

10,654. "Trolley-poles for electric tramways." W. Lawrance. April 19th.

10,668. "Wireless coil-holders, &c." J. E. Watkinson. April 19th.

10,671. "Voltaic cells and batteries." A. R. Upward. April 19th.

10,675. "Electric radiator." A. Bourgain. April 19th. (France, May 15th, 1922.)

10,681. "Filaments in thermionic valves, &c." R. Doyle. April 19th.

10,682. "Dynamo-electric machine." D. Suchostawer. April 19th.

10,693. "Accumulator grids." J. M. Burnett and W. Haddon. April 19th.

10,700. "Headpieces and telephone mountings." A. K. Cooley. April 19th.

10,706. "Electric glow-lamp bulbs." F. M. F. Sammarcelli. April 19th.

10,708. "Packing-case for electric lamps." R. Parlett. April 19th.

10,711. "Reception of wireless signals." N. Lea and Radio Communication Co., Ltd. April 19th.

10,712. "Wireless reception, &c., apparatus." N. Lea and Radio Communication Co., Ltd. April 19th.

10,714. "Sound-emitting, &c., instruments." British Thomson-Houston Co., Ltd., and J. H. Butcher. April 19th.

10,724. "Multi-core electric cables." A. W. Williams. April 20th.

10,754. "Electrically-illuminated, &c., signs." S. H. Grant and D. D. Walker. April 20th.

10,756. "Telephone systems." Western Electric Co., Ltd. April 20th. (United States, June 6th, 1922.)

10,761. "Control of arc light." C. H. Champion and C. H. Champion and Co., Ltd. April 20th.

10,763. "Regulation of electric circuits." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). April 20th.

10,776. "Electric clocks." L. Syrett and C. Topley. April 20th.

10,794. "Electric switches." P. O. Dorer. April 20th.

10,798. "Drum controllers, &c." Electro-Mechanical Brake Co., Ltd., and M. J. Pattison. April 20th.

10,812. "Control of trains." A. R. Angus. April 20th.

10,822. "Machine for coating electric lamps, &c." C. Barclay, R. Gordon, and Gordon & Barclay. April 21st.

10,855. "Sparking plugs, &c." A. Craig and J. A. Kemp. April 21st.

10,858. "Alternating-current utilisation." W. Langdon-Davies. April 21st.

10,869. "Lead-in insulator for wireless apparatus." T. C. Davis. April 21st.

10,875. "Three-electrode valve." R. W. Pyne. April 21st.

10,880. "Terminal connections for electric circuits." British Radio Wireless Manufacturing Co., Ltd. April 21st.

10,882. "Insulating cap for electric cable joints." F. M. van Gelderen. April 21st.

10,890. "Plug connectors for electric circuits." N. L. Boyden and C. M. Lewin. April 21st.

10,896. "Electric installations comprising condensers." D. A. Soulier. April 21st. (Belgium, May 17th, 1922.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

10,283. "Electrically-operated driving and reversing mechanism." Vickers, Ltd., Sir J. McKechnie, and L. H. Bateman. January 4th, 1922. (195,654.)

25,591. "Radio localisers." C. C. Culver. September 27th, 1921. (195,656.)

25,695. "Electric liquid heaters." Festa Akt. Ges. (in liquidation). October 7th, 1920. (Addition to 158,842.) (169,975.)

26,089. "Relays for the reception of signals, vibrations, and the like." C. P. Ryan. April 10th, 1922. (195,657.)

26,127. "Transmission of signals by electric oscillations which are guided or carried by line wires." Dr. E. F. Huth Ges. and Dr. J. Oppenheimer. October 2nd, 1920. (169,724.)

31,536. "High-frequency telephony." Ges. für Drahtlose Telegraphie. February 5th, 1921. (175,245.)

32,377. "Apparatus for preventing the occurrence of higher harmonic currents in the working of metal-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. December 6th, 1920. (172,325.)

32,657. "Vacuum tubes." E. Y. Robinson. December 6th, 1921. (195,691.)

32,892. "Measurement of alternating voltages of any frequency." E. B. Moullin. December 7th, 1921. (195,698.)

34,790. "Electric incandescent lamps." J. F. Lymburn. December 28th, 1921. (195,708.)

35,084. "Wireless transmission by aid of a signalling key." H. Sefton-Jones (C. Lorenz Akt. Ges.). December 30th, 1921. (195,718.)

1922.

14. "Ignition systems for internal-combustion engines." W. G. M. Ross. January 3rd, 1922. (195,721.)

18. "Cleats and cleat bases for electrical conductors and the like." A. Kirk and R. C. Milliken. January 3rd, 1922. (195,722.)

267. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. January 4th, 1922. (195,739.)

296. "Explosion-proof electric fuses." E. C. R. Marks (Goodman Manufacturing Co.). January 4th, 1922. (195,743.)

423. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 13th, 1921. (181,675.)

424. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 16th, 1921. (Addition to 181,675.) (184,766.)

425. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 5th, 1921. (Addition to 181,675.) (188,627.)

631. "Means for electrically bonding metallic-sheathed wires or cables and the like." G. S. Boothroyd and Callender's Cable and Construction Co., Ltd. January 9th, 1922. (195,762.)

662. "Electro-magnetic switches for train lighting and similar installations." J. Stone & Co., Ltd., and C. E. Adams. January 9th, 1922. (195,763.)

663. "Cooling or ventilating of enclosed electric motors." D. A. Evans and H. Hodgson. January 9th, 1922. (195,764.)

765. "Manufacture of brushes of agglomerated graphite for electrical machines." "Le Carbone" Soc. Anon. April 7th, 1921. (178,071.)

815. "Electrolytic apparatus for production of seamless articles." S. O. Cowper-Coles. January 10th, 1922. (195,775.)

1,020. "Wave filters." Western Electric Co., Ltd. (Western Electric Co., Inc.). January 12th, 1922. (195,782.)

1,363. "Gas-filled electric glow discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 10th, 1921. (175,254.)

1,394. "Electric light baths." W. M. Edwards. January 17th, 1922. (Cognate applications 6,262/22 and 27,612/22.) (195,790.)

1,583. "High-frequency telephony." Ges. für Drahtlose Telegraphie. February 11th, 1921. (175,256.)

1,628. "General character signal-transmitting device for wireless, flash-light, and land line systems of telegraphy." E. J. Quinn. January 19th, 1922. (195,796.)

1,739. "Electric heaters for chicken and other incubators, chicken-brooders, drying and heated cases for birds and animals and the like." A. Wilson. January 20th, 1922. (195,799.)

2,145. "Telephone systems and impulse senders for use in connection therewith." Automatic Telephone Manufacturing Co., Ltd. February 9th, 1921. (175,266.)

3,117. "Heat-deflecting device particularly for electrical rheostats and the like." Thermal Electric Works (Hackbridge), Ltd., and E. Swainson. February 2nd, 1922. (195,813.)

3,221. "Variable inductances for wireless reception apparatus." G. Castagnoli. February 3rd, 1922. (195,814.)

3,232. "Means for laying and picking up submarine cables and the like." F. E. Pernot. February 3rd, 1922. (195,815.)

3,321. "Telephone signal device." T. McKenna (Dictograph Products Corporation). February 7th, 1922. (195,817.)

4,200. "Electro-magnetic mechanism." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. February 13th, 1922. (195,824.)

4,734. "Apparatus for regulating the amplitude of the pendulum or the like in electro-magnetic clocks." M. P. Favre-Bulle. February 17th, 1922. (195,827.)

5,370. "Explosion-proof electric motors and the like." C. W. Major and Metropolitan-Vickers Electrical Co., Ltd. February 23rd, 1922. (195,832.)

5,511. "Illuminated signs." E. T. R. Murray. February 24th, 1922. (195,833.)

5,800. "High-frequency signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). February 27th, 1922. (195,838.)

6,437. "Locking devices for electric incandescent lamps, fittings, and the like." J. Stone & Co., Ltd. (R. R. Bury). March 4th, 1922. (195,845.)

8,465. "Electric drives for sound-reproducing machines." British Thomson-Houston Co., Ltd. (General Electric Co.). March 23rd, 1922. (195,861.)

8,793. "Telephone systems." Siemens and Halske Akt. Ges. March 31st, 1921. (177,781.)

9,034. "Hand tools for connecting telephone and like wires to insulators." P. T. Nielsen. March 29th, 1922. (195,865.)

12,769. "Electric incandescent lamps and switches therefor." G. Morel. May 5th, 1922. (195,878.)

12,847. "Electro-magnetic sound boxes for phonographs and the like." Telegraphie Ges. System Stille and Dr. C. Stille. May 6th, 1922. (195,879.)

15,978. "Protective mount for fixing electric meters on consumers' premises." E. C. R. Marks (Soc. Anon. Appareillage Theco). June 8th, 1922. (195,895.)

16,642. "Electric heat radiator for therapeutic purposes." Quarzlampen Ges. June 15th, 1921. (181,723.)

18,581. "Ramp for re-railing railway and tramway vehicles." W. A. Marchant. July 6th, 1922. (195,899.)

18,737. "Electric resistance switches." Ward Leonard Electric Co. and G. W. Camp. July 7th, 1922. (195,900.)

19,277. "Filament resistance rheostats." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 13th, 1922. (195,903.)

19,943. "Electrically-illuminated signs." W. C. C. Hawtayne and General Electric Co., Ltd. July 20th, 1922. (195,905.)

19,944. "Means for adjusting electric lamp holders in lanterns." T. Taylor and F. H. Morris. July 20th, 1922. (Cognate application 23,660/22.) (195,906.)

24,150. "Electrically-driven power shovels." Metropolitan-Vickers Electrical Co., Ltd. September 12th, 1921. (185,742.)

32,342. "Railway, tramway, and road vehicles." C. E. Holden. November 27th, 1922. (195,919.)